THE PHILIPPINE
AGRICULTURAL REVIEW

6
1913
no. 1-6

VOL. VI JANUARY, 1913 No. 1

The Philippine Agricultural Review

SPECIAL ARTICLES

THE LOCUST PEST

By C. R. Jones and D. B. Mackie

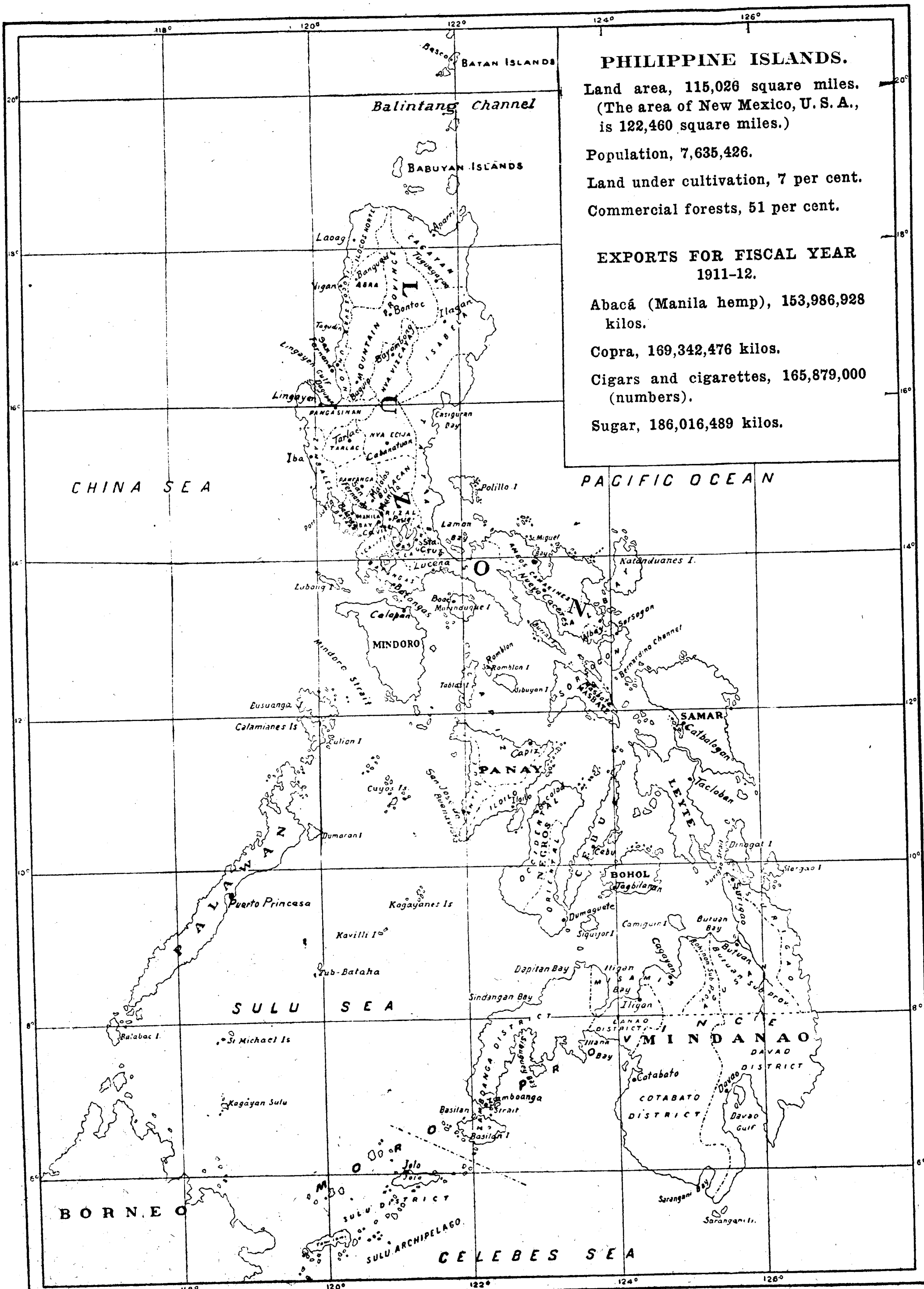
THE MANUFACTURE OF PAPER FROM ABACA (MANILA HEMP)

By M. M. Saleeby

A MONTHLY PUBLICATION
ISSUED IN ENGLISH AND SPANISH
by THE BUREAU OF AGRICULTURE
The Government of the Philippine Islands
Department of Public Instruction

MANILA
BUREAU OF PRINTING
1913

(Entered at the post-office at Manila as second-class matter.)


PHILIPPINE ISLANDS.
Land area, 115,026 square miles. (The area of New Mexico, U. S. A., is 122,460 square miles.)
Population, 7,635,426.
Land under cultivation, 7 per cent.
Commercial forests, 51 per cent.
EXPORTS FOR FISCAL YEAR 1911-12.
Abacá (Manila hemp), 153,986,928 kilos.
Copra, 169,342,476 kilos.
Cigars and cigarettes, 165,879,000 (numbers).
Sugar, 186,016,489 kilos.
BATAN ISLANDS
Balintang Channel
BABUYAN ISLANDS
LUZON
CHINA SEA
PACIFIC OCEAN
MINDORO
Mindoro Strait
PANAY
SAMAR
LEYTE
BOHOL
PALAWAN
SULU SEA
MINDANAO
MORO PROVINCE
BORNEO
CELEBES SEA
SULU ARCHIPELAGO
Manila
Cebu
Iloilo
Zamboanga
Jolo

(*a*) Heap containing 57 cavans of "voladores," caught with nets in five hours at Mandaue, Cebu.

(*b*) Pit method—driving the loctones through the "V" into the pit, Province of Cebu.

THE PHILIPPINE

Agricultural Review

VOL. VI JANUARY, 1913 No. 1

CONTENTS.

115489

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

Dr. GEORGE S. BAKER.

It is with the deepest regret that announcement is made of the death in San Francisco of Dr. George S. Baker, inspector in charge of the San Francisco station of the Bureau of Animal Industry, U. S. Department of Agriculture.

Doctor Baker was a pioneer in the meat-inspection service, having seen it grow from the small beginning, as a political institution, to the wholly scientific organization which it now is. On account of Doctor Baker's ripe experience and cool judgment his services for the year past were loaned to the Bureau of Agriculture by the United States' Bureau of Animal Industry to assist in solving some of the important problems connected with cattle importation and meat inspection. During his stay in Manila he contributed largely to the solution of the cattle-importation problem and wholly reorganized the meat-inspection methods of this Bureau, thereby leaving behind him in the Philippines, as he did in the United States, monuments of constructive work.

THE PRESENT STATUS OF THE LOCUST QUESTION.

By O. W. BARRETT, *Chief, Division of Horticulture.*

Were we not more or less familiar with the matter from experience in expecting serious results in that line to happen, the question of locust ravages in the Philippines would equal, if not exceed, in our minds, that other curse of the Archipelago, the typhoons. In almost every province, and in nearly every island of any importance in the Visayas, there are now, have recently been, or may be at any moment, locust outbreaks. In perhaps one-half of the cases a swarm may be readily exterminated provided the machinery of the Government offices concerned can be directed without hindrance or delay upon the center of infestation at the right time. The most serious aspect of the whole question, however, is, at present, the impregnability, so to speak, of the locust-breeding areas which continue to propagate and send forth to the destruction of valuable crops vast numbers of these voracious insects.

There are, however, several encouraging features in the locust question to-day: The people in the infested districts are now better informed than ever before as to the habits of the insects and the most efficient methods of destroying them; excellent rules and regulations are now legally effective in nearly all of the provinces and these measures actively supported by the provincial officials of all grades form the basis for a fighting organization which only requires the direct application of a sufficient amount of labor to establish complete control of all swarms in all cultivated lands; the recent increase of appropriation for locust-destruction work by the present Philippine Legislature indicates a highly commendable spirit and a good understanding of the situation on the part of the members thereof.

While the evil of obscure breeding areas remaining in the interior of several districts may continue for some little time to come to be a menace to Philippine agriculture, it is clearly possible to prevent hereafter any further losses of such magnitude as we have recently experienced, and the outlook for the complete eradication of the pest in the Philippines within a few years is decidedly favorable.

THE LOCUST PEST.

By C. R. Jones, *Entomologist,*

AND

D. B. Mackie, *Assistant Entomologist.*

The migratory locust is, and for many years has been, the most destructive insect pest of the Philippines. Included in the term locust are at least three, if not five, distinct varieties and species belonging to the genus *Acridium;* some seem confined to the Visayas while others occur only in Luzon; the habits of all, however, are practically identical. This pest is by no means peculiar to this Archipelago, since Argentina, India, and practically the entire African continent suffer the loss of many million pesos annually from the various members of the locust tribe.

Unlike most other insects which attack economic plants, the migratory locusts are able to exist indefinitely in uncultivated lands, such as cogon-filled caiñgins, and from these clearings, which may be on mountain slopes or on well-drained ground in the interior of any island or the hinterland of any province, the swarm may finally descend without warning upon the cultivated fields. Even in these breeding areas the insects may not appear to be in great numbers at any given time, but sooner or later, prompted by the migratory instinct, the more or less numerous small colonies or swarms assemble into swarms containing hundreds of millions of individuals and, after a preliminary period of short local flights, proceed to new breeding grounds which may be hundreds of kilometers distant.

To one not familiar with their habits, the immensity of these swarms is almost incomprehensible; in many instances the entire sky is darkened for several hours during the passage of the swarm, while there were numerous instances during the past season in the Visayas in which bamboos and even coconut leaves were broken down through the sheer weight of the insects which had alighted thereon. Not only do districts adjacent to the breeding grounds of the original swarms suffer from attacks but even areas separated by strips of ocean and even mountain ranges are afflicted. This is accounted for by the fact that all the members of a given swarm do not deposit their eggs simultaneously. The older females becoming heavy with the weight of their eggs begin to lag behind and to oviposit in nearby

districts while the younger individuals continue the migration for several days, if not weeks, before finally selecting a site for their quota of egg laying. This feature is really the most serious one of the whole subject and the destruction of the several swarms, perhaps a series of swarms extending over perhaps the entire line of migration, constitutes one of the most difficult problems with which the Philippine agriculturist has to contend to-day.

In the Visayan provinces alone the loss to agricultural crops during the past six months amounts to upwards of ten million pesos. Most of this damage has resulted indirectly from one or two swarms originating in Bohol and extending over Cebu and Negros. It is believed that the swarms which recently have invaded Panay originated in the adjacent island of Guimaras. In Mindanao there are vast areas of practically uncultivated lands which form ideal breeding grounds for this pest; and in these areas it will be for some time to come practically impossible to eradicate the locusts.

To repeat then, every province containing uncultivated areas overgrown with cogon grass has its own sources of locust infestation. Small swarms may breed for several seasons in these abandoned areas, only migrating therefrom upon attaining sufficient vigor and numbers to necessitate a change of feeding area. At present, locust swarms are known to exist in some state of development in at least twenty-four provinces, while their existence is suspected in four others.

In order that the readers of the REVIEW may understand fully the principal features in the development of the migratory locust, the following notes, based upon experiments carried out by the division of horticulture during the past few months, are offered.

LIFE HISTORY.

The egg.—The eggs of the locust (fig. 1) are deposited in earth in clusters of from sixty to eighty. The individual eggs in the clusters are laid in rows side by side obliquely across the egg mass (fig. 2); the entire cluster is inclosed in a more or less waterproof viscid secretion which not only binds the eggs together in the mass, but at the same time acts as a protection against excessive moisture and parasites.

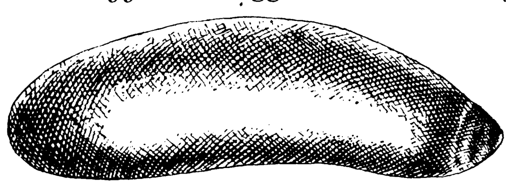


Fig. 1. Egg of locust greatly enlarged. (After Riley.)

The depth at which the egg clusters are placed depends somewhat upon the character of the soil; in compact alluvial soil the bottom of the hole is usually about 4 centimeters below the level of the surface, while in loose sandy soils the holes may be 7 or even 8 centimeters deep. The female locust is provided with two sets of hard-pointed valves at the tip of the abdomen; this entire structure is known as the ovipositor. By opening and closing these hard sections of the ovipositor and by gently moving the abdomen itself from side to side and upward and downward, a cavity large enough to contain the egg mass is made during the space of one or two hours.; it should be noted that no particles of earth are removed from the cavity, the soil grains being simply forced aside by the piston-like action of the abdomen and the lever action of the ovipositor valves.

Fig. 2. Eggs of the migratory locust with protective covering removed. (Original.)

The abdomen, itself, is extended somewhat during egg laying so that the bottom of the cavity may be at a greater distance below the surface than the normal length of the abdomen. Above the egg cluster the remainder of the cavity up to the surface of the soil is partially filled with the same frothy substance which envelops each egg; this secretion prevents the loose earth from settling back into the hole on top of the eggs—which might

obstruct the exit of the young nymphs at the moment of hatching. From recent experiments by the writers it is found that excessive moisture is highly injurious to the embryonic development in the eggs; except for this waterproofing which the female locust places over her egg cluster, it is probable that comparatively few locust eggs would hatch during the rainy season.

The writers have found the average period of incubation of the Philippine migratory locusts to be from eighteen to twenty days, the minimum being seventeen, and the maximum twenty-three and a half days; in case of extreme drought it is possible that a month might pass between oviposition and the emergence of the swarm.

Three days after being deposited the individual eggs begin to swell, probably from the absorption of moisture, and at the time of hatching are nearly one-fifth larger than when laid.

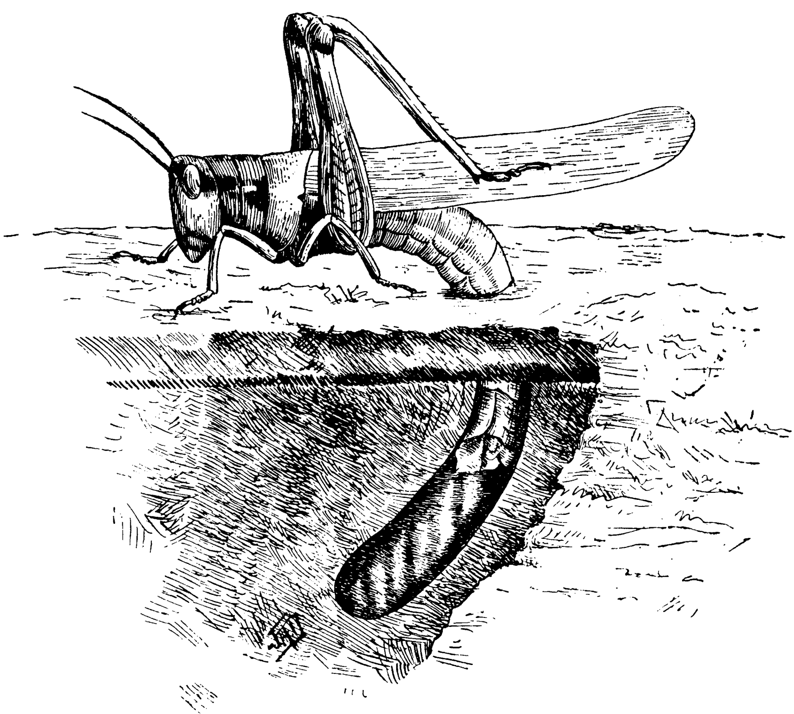


Fig. 3. Locust depositing eggs. (After Riley.)

The nymph.—Upon hatching, the young insect rapidly forces its way up through the protective covering of the egg mass to the surface of the soil. Upon emerging from the ground they

are a pale gray or fawn color and are covered with a thin film which soon dries and falls off in flakes. The young nymphs, or "loctones," closely resemble the adult, except that they are wingless and possessed of a disproportionately large head. In the course of an hour they will have changed to a slaty or brownish shade and will have slightly increased in size by reason of the minute breathing tubes in the body having become fully distended with air.

Within a few hours after emerging from the egg mass the young loctones develop ravenous appetites and begin eating. They do not, however, feed to any great extent at night, usually "going to roost" at nightfall; a grass stem or leaf is selected and, clinging tightly to this support, the young insect passes the night, striving, if possible, to avoid exposure to rain and dew.

Almost every kind of green herbage is liable to attack; sweet potatoes, tobacco, and beans are frequently passed over by the young loctones, but not even burí and coconut leaves are exempt from the attacks of the "voladores," or flying adults. Hard substances, like sugar cane, the stems of shrubs, maize stalks, etc., usually escape destruction.

The traveling instinct is very early in evidence, the young insects beginning to move in a definite direction after the first day or two of their existence; while at first only a few meters per day may be covered, by the time they are ready to molt the last time 3 or 4 kilometers may be traversed from sunrise to sunset.

The sudden appearance of vast numbers of these young loctones in a chain of localities over which the flying swarm had passed three weeks or so previously gave rise to an old belief which is not quite out of existence yet, i. e., that the young locusts are of *spontaneous origin*, some people even believing that they are sent by a special act of Providence to punish the community for some real or fancied sin.

The average time required for the nymph to reach full maturity, that is, to gain its wings, is about fifty-four days. During this period there are five molts. When ready to molt the hopper ceases feeding, crawls on some grass stem or similar object and fastening itself thereto with the claws of the hind feet, hangs head downward, motionless, for several hours. The thorax, or middle part of the body, gradually swells until the skin splits down the back; then by a series of muscular contractions, the rent in the old skin is enlarged until the body of the insect can gradually work its way out. The old skin remains attached to the grass stem, or other object, in its original position, the hopper

usually clinging to it for a short time until its tender new skin begins to dry and its legs to stiffen sufficiently for it to be able to move about. Within half an hour or so the hopper moves from the old skin to a new position, no longer remaining head downward, and there it keeps a quiet pose until the entire outer integument is quite firm again, when with a renewed appetite it again falls to feeding upon the nearest green herbage.

The adult.—At the fifth molt the wings, which have been merely indicated by minute processes at the back of the thorax, are brought into full evidence. At this molt the locton rests for a considerable time after emergence from the old skin, with the wing "buds" hanging downward in order that the blood may gravitate into them, thus facilitating the rapid and complete extension of those organs. Only some forty-five minutes are required for drying the wings after emergence. Fig. 4 illustrates the position of the insect at the last molt just before leaving the old skin—the heavy tips of the wing "buds" bending forward contain as yet no veins or framework to hold them straight in the normal position which they will assume as soon as the insect, now called a "volador," reverses its position.

Fig 4. Last molt—changing from hopper to adult. (Original.)

After all the loctones in a swarm have acquired their wings, they usually remain for a few days longer in the immediate vicinity of their previous operations, sometimes even refusng to leave the old feeding grounds at all, provided, of course, that they find a full supply of herbage and everything else there to their satisfaction. Usually after a few short local flights, however, the migratory instinct asserts itself and the entire swarm mounts into the air and proceeds, usually with the wind, at the rate of about 30 kilometers per day, to a new breeding ground. Little is known of the exact conditions which influence the direction and extent of the flight of these swarms. Sometimes a swarm is seen to retrace its flight several times before becoming satisfied with a

particular site for egg laying. Soon after attaining their wings the adults are very active and readily take flight upon the slightest alarm; this characteristic, however, does not hold true for the later portion of the adult period of existence. A distinct odor is given off by the mature insects, especially just before and during the mating period which may last for several days. The presence of a swarm, even when it has alighted at night, may readily be detected at a distance of 5, or even 8, kilometers with a favorable wind. In a lesser degree the loctones themselves exhale a similar effluvium.

Soon after mating the females become so heavy with eggs that they can not fly with much ease and in this sluggish state they readily fall a prey to any birds or animals which happen to be near. The male may or may not die soon after copulation; the female does not live more than one or two days after ovipositing; old swarms contain a surplus of males.

The fact that the female locust deposits the entire number of her eggs in one cluster is of great importance in the work of the destruction of these insects. However, it is a very unfortunate fact for the Philippine planters that all the females of a given swarm do not deposit at the same time, nor in the same locality. It appears that due to unfavorable weather or local conditions a gravid female may carry her eggs for several days beyond the period when they are ready for oviposition.

As an evidence of the extreme degree of the gregarious sense of the migratory locust, we would mention the fact that the females of a swarm instinctively crowd together so closely while ovipositing that under ordinary conditions some 4,000 to 5,000 egg clusters are placed in one square meter of soil surface; this does not mean, however, that an equal number of female locusts were to be found in such space at any given moment of time. From these figures it is seen that from each square meter of soil surface in the area where females have oviposited, from 20,000 to 30,000 young hoppers may be expected to emerge provided neither natural enemies, bad weather, nor human methods are employed against them; when we multiply these figures by 10,000 we begin to realize the number of hoppers that may emerge from one hectare of ground.

CONTROL OF THE PEST.

The control of the migratory locust may be studied under two heads: First, artificial—which includes all methods of human control, such as spraying, driving into pits, netting, crushing, burning, inoculation, poisoning, etc.; and second, natural—which

includes influences by wind, rain, etc., and also enemies such as predaceous insects, birds, and animals, and true parasites.

The complete destruction of a winged swarm is practically impossible though, under favorable circumstances, a very large proportion may be caught in nets or, more rarely still, killed by means of contact sprays, such as kerosene. Therefore, the attention of those engaged in locust-destruction work must be directed against the eggs and loctones, or immature insects. In certain conditions it is, of course, impracticable to exterminate an extensive swarm of even young hoppers, and, in most cases, it is impossible to crush, bury, or dig out all the egg clusters even in cultivated areas. There are notable cases, however, of the total destruction of a swarm of locusts by systematic co-operative work—for instance, that performed by the Governor of Iloilo in his famous locust campaign of that province in 1910.

The destruction of eggs in cultivated ground is a matter of great importance, and, whenever practicable, should be carried out as thoroughly as possible. In fields where locusts have oviposited, the plowing of the ground is sometimes very effective, though by no means does it ensure the destruction of all the egg clusters. Where a plow with a mold-board is used, one thorough plowing is usually sufficient to bury nearly all the egg masses to such a depth that when the loctones hatch they are unable to make their escape from the earth and are, therefore, smothered therein; but when the ordinary Filipino plow is used it is necessary to either roll the land directly after plowing or to pack it by means of hand mauls. (Plate II, *a*.)

In land where a plow can not be used, excellent results have been obtained in many cases by digging out the eggs by hand, these eggs being destroyed by either crushing or pouring boiling water over them; at Carcar, Cebu, eleven persons engaged in digging out egg clusters averaged about 125 liters (about six kerosene cans full) of egg clusters per day.

APPROVED METHODS OF LOCTON DESTRUCTION.

Pit, or driving, method.—By far the most important method of combating the young insects is the common pit, or driving, method. While there are conditions under which this method can not be used with very good results in cultivated ground, it almost always is the best method to follow. Its application is not only simple but the Philippine planters in every province have been more or less familiar with its operation for many years. Its principal fault, however, is that the roofing-iron

sheets, or some similar material, which is required for the construction of the fences leading to the pit, are not always readily available; it is manifestly impracticable to carry large quantities of galvanized iron over bad roads into interior districts, especially where there is a scarcity of labor, such as in the interior districts of the Islands of Negros and Samar. In cases where it is inadvisable to attempt the use of roofing sheets, earthen dikes faced with sections of banana sheaths constitute a very effective method; the leaf-blades of the banana should not be used unless the swarm is a small one, because of the fact that the insects quickly devour the green portion of the leaf.

Plate I, *b*, indicates the appearance of a typical locust pit when full-width sheets are used. In most cases, the ordinary roofing sheet may be cut in two lengthwise, since this doubles the number of serviceable sheets and greatly facilitates handling and transportation; with very young loctones sheets cut in thirds may be used.

Considerable care should, of course, be taken in the construction of one of these pit fences in order that it may have no places where the loctones may escape through joints between sheets and that no brush or grass be left in such a position that the insects can climb over the fence. At the point of the "V" or "U" shaped structure, a pit about 1 meter wide, 1 meter deep, and 1 meter long should be constructed to receive the insects. The upper edge of this pit should be faced with iron sheets, banana-leaf sheaths, or at least banana leaves, to prevent the hoppers from crawling out of the pit.

Generally speaking, the pit fences should be erected a short distance, say 20 meters, in front of the advancing swarm; after both the fence and pit have been inspected by someone experienced in this work, as many men and boys as the size of the swarm may require take their places behind the swarm and with sticks and branches begin urging the loctones toward the pit. Inexperienced drivers in their zeal sometimes confuse the loctones by trying to force them to travel too rapidly and thus the swarm may resolve itself into a wildly struggling mass, whose movements can not be directed for some time thereafter. Under ordinary circumstances, after the construction of the fence and its pit, the entire swarm, if of moderate size, i. e., covering only some 100 square meters or more, should be inside the pit within one hour from the beginning of the drive.

The method of destroying the insects in the pit is of secondary importance, the most common and one of the best being trampling

with the feet; covering with sods or earth, or tamping with heavy sticks or mauls, are also simple and effective.

The principal difficulty with the pit method is found in the fact, that, in many cases, a swarm is not concentrated, i. e., it may not have a definite boundary; there may be in a certain field or cogonal some five to ten or more partially unified swarms, but by careful management it is usually possible to use the same fence for more than one such section of the general mass of loctones in such an area.

It is estimated that the pit method accomplished the destruction between June and October of upwards of 8,000 cavans [1] of hoppers in Bohol, while within a very short space of time some 20,000 cavans were reported to have been destroyed in Iloilo, and the total amount for the Province of Cebu may be estimated anywhere between 10,000 and 25,000 cavans.

Nets.—On level ground a large cone-shaped net, or bag, may be used to destroy the young hoppers with considerable success. The side of the net which comes in contact with the earth should be held straight by means of a straight stick; the upper part of the net should, of course, have a "bejuco" or bow-shaped piece of wood attached to the rim to hold it wide open. In certain cases extra large nets for use with horses (carabaos being too slow) may be used. Both in India and Argentina large nets drawn between trotting bullocks or horses are used with good success.

The insects caught in the bottom, or rear portion, of the net may be killed either by crushing or by dipping into hot water. The net should be constructed of coarse cloth—either canvas or gunny-sack material.

Nets having a circular frame for keeping the mouth open and mounted on short stiff handles may be used to good advantage in capturing voladores; even when "roosting" the winged insects may be captured in large numbers by beating these nets against the herbage and shrubbery where the insects have settled. In August one of the writers put this method to the test in a barrio of Cebu which was invaded by a large swarm of the flying insects, and in one hour three men using these nets captured 12 cavans of insects; also at Mandaue, Cebu, sixteen nets caught 57 cavans of voladores in five hours. (Plate I, *a*.)

Unfortunately, perhaps, in Cebu the people seldom use the locusts for food; in several provinces of Luzon, however, in the Island of Negros, and to some extent in Leyte and Bohol, the

[1] One cavan=75 liters.

Filipinos employ these nets not only to capture the locusts but to procure at the same time a quite wholesome and proper food. (The locust is a particularly cleanly insect in its habits, and beliefs as to its sometimes carrying cholera germs are probably without foundation; provided typhoid, cholera, or other similar germs could exist in a virulent state upon grass or other herbage until same was consumed by locusts, there is a possibility that the said germs might pass to human beings using the insects for food, though the possibility seems to be too remote for consideration; at least the danger from contagious diseases through eating locusts is an absolutely negligible idea, provided the locusts are roasted or otherwise cooked before eating).

Rolling.—In young cogon grass on level ground a section of buri-palm trunk, or a straight smooth log, at least 40 and better 60 centimeters in diameter, drawn by carabaos or cattle, attached to either end, may be used to crush the loctones with considerable success.

Burning.—Where the young hoppers are hidden in grass and brush on rough ground, it is sometimes feasible to cut the herbage over the infested area and set fire to it as soon as it gets dry enough to burn. This, of course, will also apply to an area in which it is definitely known locust eggs are about to hatch. As soon as the locusts appear and collect upon the dried grass and brush they may be almost completely destroyed if the material for burning be in fair quantity. The burning method is particularly practicable in the cogonales in uncultivated districts; the great amount of labor necessary for cutting the grass is the principal objection to this method, while another is the fact that it can seldom be used in the rainy season.

In some cases the swarm, if well concentrated in a dense line, may be quickly destroyed by the use of a special apparatus using a burning jet of petroleum; an ordinary spray pump with the nozzle fastened to the end of a pole about 2 to 2½ meters in length may be converted into a powerful burning torch which is effective even in rainy weather; the flame from this burning jet will readily penetrate any cogon grass or brush. Any surplus oil which may escape the jet flame continues burning on the insects or herbage. The objections to this method are the cost of the petroleum and the danger from burning accidents when the apparatus is in the hands of inexperienced operators.

Insecticides.—Locusts in any stage of development may be killed either by contact sprays or by poison solutions. The simplest method is perhaps kerosene, or any of the light crude petroleum oils, used as a direct-contact spray. In or near barrios

where there are valuable crops it is in many cases practicable to spray the insects with kerosene, using cheap hand pumps, the kerosene being carried in metal buckets or even in the original tins; this may also be used very effectively upon voladores while roosting at night, though it is much more effective on the young loctones.

For general field work, however, the kerosene-spray method can not be recommended very highly on account of its expensiveness; a modification of this, known as the kerosene-emulsion method, is very much cheaper and may be used very advantageously on young loctones. This emulsion is made by mixing kerosene with soap and water to form a dilute mixture or emulsion, the soap holding the kerosene in suspension; even very dilute mixtures are effective against the very young loctones. One of the authors has carried out numerous experiments with various arsenical poisons and the results have been published in a previous number of the REVIEW.[1]

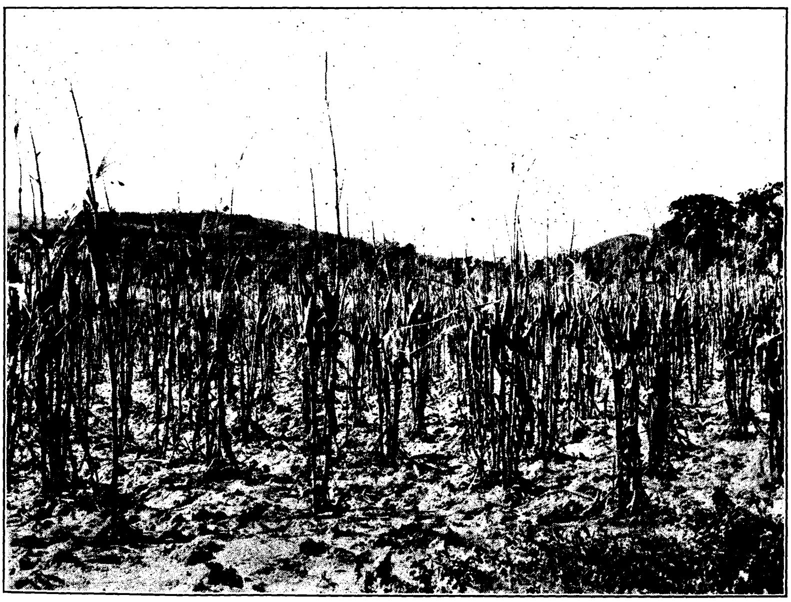
Unfortunately the use of arsenical poisons is usually attended with serious danger for the following reasons: (1) The Philippine planters are unfamiliar with poisons and the methods of using them; (2) there is always more or less danger of poisoning domestic animals through their feeding upon the poisoned grass; (3) many beneficial birds which normally feed upon locusts might be destroyed by eating the poisoned insects. In special cases, however, such poisons as lead arsenate, or a sweetened mixture of white arsenic, may be used by experienced persons with very good effect.

Inoculation.—There are two or three diseases known to attack the migratory locust, one being a fungus (*Empusa grylli*) which has been used with some success, it is said, especially in America, to artificially inoculate these insects. It appears, however, that only under very favorable conditions does this disease spread with sufficient rapidity to cause the destruction of large numbers of the insects and, therefore, considering the expense and precariousness of the results, the artificial propagation of this fungus can not be recommended for general use. It is possible, however, that sometime some bacillus, bacterium, or fungus germ disease may be discovered which can be cheaply and readily handled by means of laboratory cultures so that entire swarms may be exterminated by means of the contagion spreading from inoculated individuals to the entire swarm. Thus far the theory

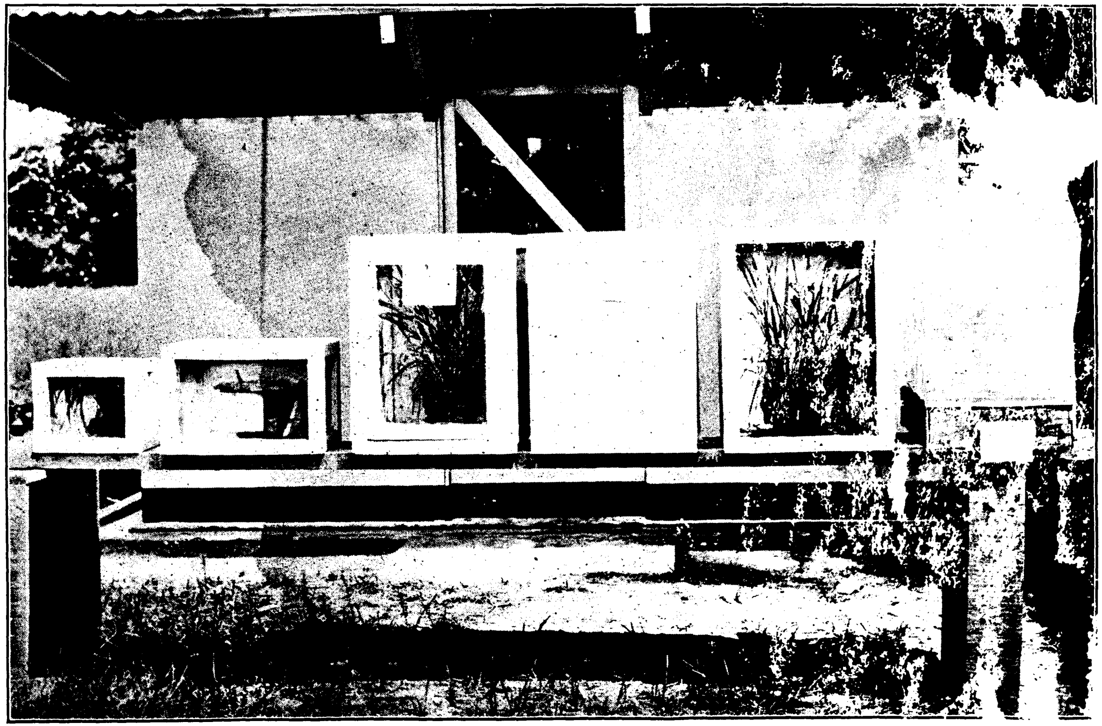
---

[1] "An Investigation of the Locust Pest in the Philippines." PHILIPPINE AGRICULTURAL REVIEW for 1910, Vol. III, No. 4, pp. 231–240.

(*a*) Egg destruction—tamping the ground with mauls.



(*b*) Maize field—showing effect of locust attack.



Locust breeding cages at insectary, Singalong Experiment Station, Manila.

Coconut leaves breaking under the weight of "voladores," or adult locusts, Province of Cebu.

regarding these inoculatory remedies is excellent but the practice is not only discouraging in its efficacy but very expensive and difficult.

Natural control.—Rainfall is undoubtedly the principal feature of the natural control of migratory locusts. There is no question but that vast numbers of young hoppers are destroyed by heavy rainfalls, especially if these occur just after or during a moulting period or at the time of hatching. The water adhering to the surface of the body drowns, or rather suffocates, the young insect almost as much as if it were immersed in a stream. Of course, if the insects have reached the winged state, the wing-covers serve to protect most of the spiracles, or breathing pores, on the sides of the abdomen.

As an instance of the destructive effect of heavy rainfalls may be mentioned the case at Alcala, Pangasinan: On August 9, oviposition occurred over a vast cogon area in that place, the average number of egg clusters per square meter being about seventy; on August 10 a very heavy rain caused this area to become thoroughly soaked and even partially inundated by the overflow of the Agno River. A deposit of silt brought by the flood occurred over a considerable part of the oviposited area, thus covering the clusters to a depth of several millimeters with a nearly air-tight paste of fine mud; on September 5 an inspection of this area revealed the fact that only a very small percentage of the eggs had hatched, or at least there were but very few of the loctones in evidence, the rest almost certainly having been suffocated in the egg burrows. The presidente of Alcala stated that only three gantas of loctones had been destroyed in this locality, although the finding of hundreds of cavans was, of course, to be expected. It is believed that practically all of the submerged egg clusters were destroyed, the few hoppers in evidence, it would appear, having come from the elevated portions of the areas which were not reached by the flood; thus, reckoning 60 eggs per cluster, or 4,200 per square meter, the average number of locusts which normally would have appeared in one hectare is upwards of forty millions, or probably some billions of insects in the entire area; each one of these insects, except for the rain and flood, would have probably destroyed at least half a kilo of herbage during its lifetime. (According to H. Maxwell Lefroy, chief entomologist of India, a migratory locust consumes about 300 times its own adult weight in food.)

It appears that not only do heavy rains kill outright the eggs and very young loctones, but even excessive moisture in the soil

during the incubation period seems to reduce considerably the vitality of the young insects. To prove this, various experiments have been conducted by the writers. It was found that submerging egg clusters for three days affects the vitality of the eggs considerably, while four days under water results in the destruction of about 25 per cent, and six days' submergence completely destroys all the eggs in the cluster. More interesting still, perhaps, is the fact that egg clusters thoroughly drenched daily with water but not submerged therein, produced weak young loctones, none of which lived for more than eight days after hatching, and some for only one day, the degree of vitality depending apparently upon the amount of wetting the clusters received during incubation.

Winds unquestionably destroy swarms of voladores when venturing to cross from one island to another. Several cases of swarms having been drowned in the sea have been reported to this office. It appears that any head wind seems to demoralize the swarm which, clinging firmly at first to its instinct of proceeding in a certain direction, may become confused at being swept out of the chosen path and not realizing the danger beneath, settles upon the water to await a more favorable condition. They are, of course, quite unable to rise from the water once having touched it.

Predaceous enemies.—Under this head may be classed birds (including poultry), domestic animals, such as dogs and pigs, and insects. The cannibal habits of the locusts are in many cases a very important feature; in case of the injury of an individual or even the extreme hunger of the swarm, this tendency to devour one another is strongly brought out; this characteristic is of great importance in using arsenical sprays, for as soon as the first insect in the advance of the swarm becomes affected by the poison he is devoured by his companions, which, of course, are also killed by the poison contained in the first body and so on for at least three, if not four, cycles.[1]

Although domestic fowls frequently destroy comparatively large numbers of young locusts when present in the neighborhood of barrios, they are not an important feature in locust destruction. By the same token, pigs, both wild and domestic, dogs, etc., are only apparently in some cases of economic value as consumers of locusts. Wild birds, however, are of more importance than is generally believed for they, from the very

[1] For details see "An Investigation of the Locust Pest in the Philippines." PHILIPPINE AGRICULTURAL REVIEW, 1910, Vol. III, No. 4, pp. 227–240.

first appearance of the young locusts as they issue from the ground, wage a continuous warfare upon the swarm. The following list of Philippine birds represents the most important locust destroyers so far as known at present:

LUZON SHRIKE (*Otomela lucionensis* L.). This bird ranges from Mongolia to Celebes and is usually very common in the Philippines during September and October. It is a voracious insect eater and is, therefore, one of the most valuable birds to the Philippine planter. On account of its habit of perching on fence posts, dead branches, etc., it is very often trapped or snared, against which acts on the part of thoughtless or ignorant people it should be protected by law.

CARABAO BIRD (*Bubulcus coromandus* Bedd.). This white heron is of very wide distribution, being found from Eastern Siberia to the East Indies; it is particularly fond of the society of the carabao, probably on account of the good feeding which it usually finds in the propinquity of these animals. While they readily eat small frogs, snails, etc., their principal diet is insects, such as locusts.

KINGFISHERS. The three species of this family (*Alcedinidæ*) of the Philippines are expert insect catchers, though, of course, their principal food is fish, frogs, crabs, etc., found along the streams which they frequent in preference to pastures. They do not follow locust swarms to any great distance although the largest (*Halcyon gularis* Kuhl.) is frequently found at a long distance from water courses. The other *Halcyon* (*H. chloris* Bedd.) prefers the tide flats and canals, though, when locust swarms approach its haunts, it readily feeds upon the loctones. The smallest of the Philippine kingfishers (*Alcedo bengalensis* Briss.) is a rarer form, and, therefore, of no great importance as a locust destroyer.

VARIEGATED CURLEW (*Numenius variegatus* Scop.). This bird sometimes follows locton and locust swarms in the grass lands and individually destroys a considerable number of locusts. As the two other species (*N. arquata* and *N. cyanopus*) are also of the same habits, it is safe to assume that they, too, destroy numbers of the pest.

GOLDEN PLOVER (*Charadrius fulvus*).—This beautiful bird often frequents the grassy uplands and commonly includes locusts in its diet.

BUTTON QUAIL. Two species of these birds (*Excalfactoria lineata* Scop. and *Turnix fasciata* Temm.) are known to be locust feeders, although the stomachs of the specimens examined contained only non-migratory species.

JUNGLE FOWL (*Gallus gallus* L.). While this bird is preëminently a denizen of the forest, it greedily devours locusts when appearing in its haunts.

COMMON ROLLER (*Eurystomus orientalis* L.). This bird is almost exclusively insectivorous, and, though its principal diet is beetles, it devours large numbers of locusts whenever possible.

BEE EATERS. Two species (*Merops americanus* Mull. and *E. philippinus* L.) are excellent destroyers of locusts. The few stomachs examined thus far indicated that several species of locusts and grasshoppers together with other grass insects formed their almost exclusive diet.

Insect parasites.—There probably exist in the Philippines today a number of species of parasites, both Hymenopters and

Dipters, which more or less affect the swarms of locusts especially in the interior districts. There has been no time, however, thus far, for the writers to make a thorough study of this important phase of locust destruction work. Laboratory experiments along this line are always tedious and difficult, and, while potentially important, must, under ordinary circumstances be laid on the table, so to speak, until time permits further investigation.

INFESTED AREAS.

The accompanying map (fig. 5) indicates the localities in which migratory locusts have appeared during the present season from June to November 1. The suspected permanent-breeding areas are included with the areas known to be infested for the reason that this hidden source of the stream of migratory locusts which has been for decades, if not centuries, devastating Philippine crop areas must be fully appreciated to fully understand the status of the pest to-day. The present season has been an abnormally bad one for the Philippine planters, largely on account of the remarkably long period of drought preceding the present period of outbreaks. Throughout the world dry years are notoriously bad locust years.

It was suspected at first that large swarms had emigrated from the cogon fields of the interiors of the larger islands in the Visayas on account of shortage of green food therein to the almost immediate destruction of very rich crop areas, especially in Leyte, Bohol, and Cebu; a careful study of the situation indicates, however, that most of the present trouble can be traced back to the swarms which left Bohol, probably from the sparsely populated central or northeastern portion of the island about the middle of May, crossing the straits to Dalaguete and southeastern Cebu, and finally traversing and ovipositing over nearly the entire length of the latter island. According to reports received by this office in 1911, Cebu was quite free from locust infestation. In the course of two generations the Cebu outbreaks have furnished swarms which crossed in August or September to Negros. The precise origin of the Samar and Leyte swarms remains in doubt, but it is believed that they originated respectively in central Samar and Northern Leyte. As previously stated, central Mindanao is, and probably will continue to be, a menace to the Visayan Islands, since in the vast plains of the hinterland of that Island countless swarms of these insects can breed with only the elements and a few natural enemies to interfere.

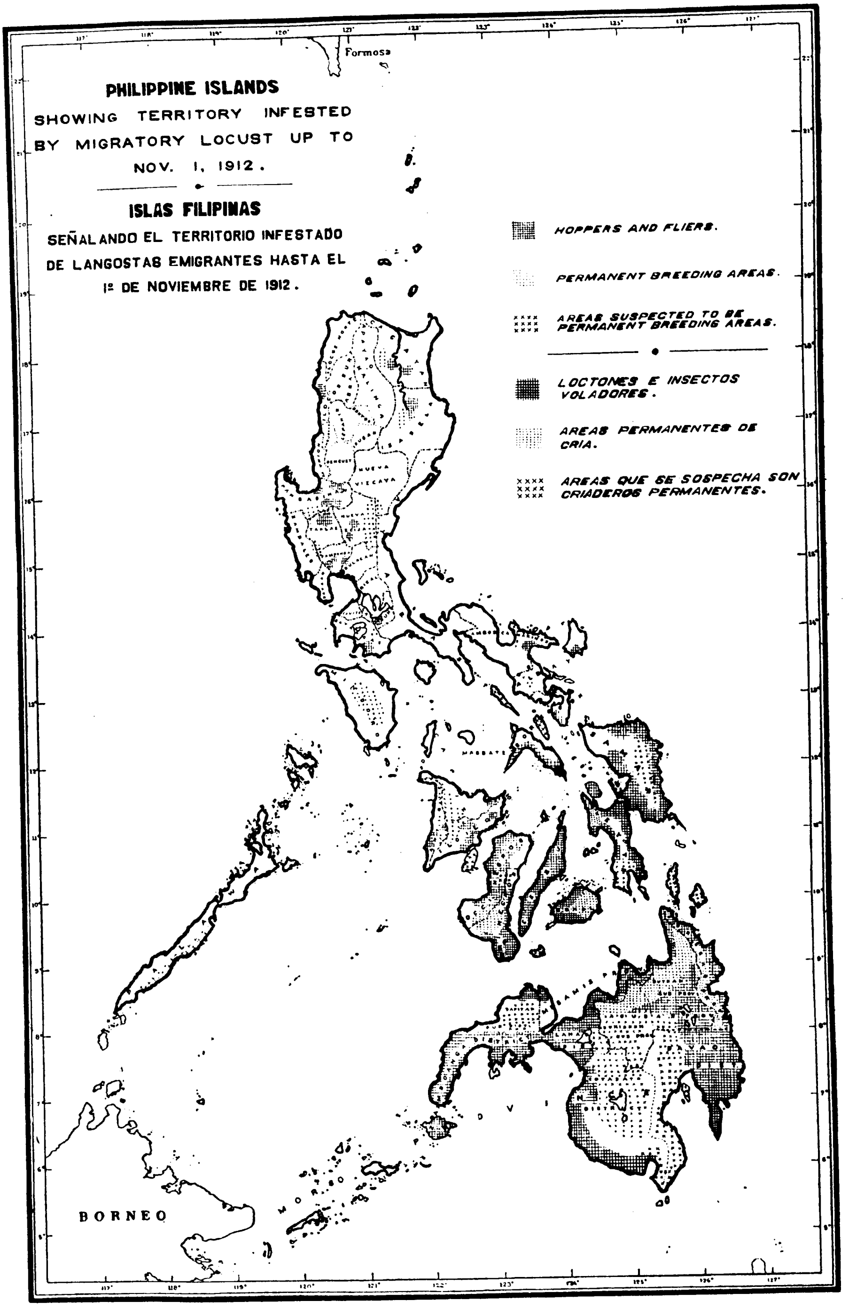

PHILIPPINE ISLANDS
SHOWING TERRITORY INFESTED BY MIGRATORY LOCUST UP TO NOV. 1, 1912.
ISLAS FILIPINAS
SEÑALANDO EL TERRITORIO INFESTADO DE LANGOSTAS EMIGRANTES HASTA EL 1º DE NOVIEMBRE DE 1912.
HOPPERS AND FLIERS.
PERMANENT BREEDING AREAS.
AREAS SUSPECTED TO BE PERMANENT BREEDING AREAS.
LOCTONES E INSECTOS VOLADORES.
AREAS PERMANENTES DE CRIA.
AREAS QUE SE SOSPECHA SON CRIADEROS PERMANENTES.
Formosa
BORNEO
NUEVA VIZCAYA
MASBATE

Fig. 5.

SUMMARY.

During the past six months migratory locusts are believed to have destroyed upwards of ten million pesos worth of crops, fully 90 per cent of which damage was done in the Visayas.

The origin of these locusts appears to have been in the Visayas, Bohol and possibly Samar and Leyte, evidently harboring the pest from the past year.

Only by coöperation on the part of the local planters with the locusts boards in each province and with the principles laid down in the rules and regulations furnished by the Bureau of Agriculture, can the pest be fully controlled. Now that the effectiveness of these measures, which have been recently put to the test in some fourteen or more provinces on a large scale, is widely known, and with the much better understanding of the entire situation and its means of control on the part of the municipal presidentes, tenientes of barrios, and the planters themselves, it is believed that the provincial locust boards and the Bureau of Agriculture will have very much less difficulty in maintaining control, if not in actually accomplishing the complete extermination of the pest.

THE MANUFACTURE OF PAPER FROM ABACÁ.[1]

By M. M. SALEEBY, *Chief, Fiber Division.*

It is interesting to review the circumstances that led some American manufacturers to use abacá (Manila hemp) in the manufacture of paper. The origin of this industry dates back to the Civil War, prior to which cotton bags were almost exclusively used for transporting flour and various other articles. During the war the production of cotton fell to an alarming extent and consequently its price advanced to such a high point that the use of cotton bags was rendered very expensive and it became necessary to look for a substitute. Strong paper was at once decided upon as the required substitute, and it was not long before abacá, in the form of old rope, was concluded to be the most desirable raw material for making such a paper. The manufacture of this paper, known to the commercial world as "Manila paper," was found to be so satisfactory as to strength and other requisites that it has ever since become a competitor of cotton in the manufacture of bags for transporting flour, cement and other similar commodities. Since the Civil War the production of cotton has increased to an enormous extent, but at the same time its price has been gradually rising, owing to the simultaneous increase in the number of uses made from it. This fact, together with the rapid development of the interstate commerce and the wonderful increase of its volume, have served to establish on a permanent basis the Manila bag industry.

Among the requisites for desirable bags such as are used for the purposes referred to above, strength, durability, and low cost are the most essential. As to the first two requisites Manila bags are in some respects superior to cotton bags. In the interstate trade, for instance, in which railway and other means of transportation are used, the former has proved to be as strong

[1] Acknowledgment is hereby made to Mr. H. B. Pond, of The International Purchasing Company, for giving valuable suggestions relative to some points discussed in this paper.

and durable as the latter, besides being also less permeable to a limited exposure to moisture. In foreign trade, however, in which steamships are the only means of transportation, cotton bags are superior to Manila bags, because of their pliability which renders them more fit to stand the rough handling to which they necessarily have to be subjected. As to the third requisite Manila bags are preferable to cotton bags, and are substituted for them in most cases in which the cost is an essential feature.

Manila paper bags are now manufactured in different sizes and of different degrees of strength. They are designated according to their capacity, the largest being strong enough to hold 50 kilos each, and some even more.

Besides being used in the manufacture of bags, Manila paper, owing to its superior strength and toughness, is also being used in the manufacture of sandpaper and for insulating purposes. The so-called Manila paper used for making ordinary paper bags and wrapping paper for use in grocery stores, is generally made from wood pulp or jute, and the term as it is thus applied is therefore a misnomer.

About the year 1900, or perhaps a little earlier, it was discovered that the supply of old Manila rope would in a few years be insufficient to meet the growing demand. Again the paper manufacturers resumed the search for some other raw material that might be used along with old rope. Sisal, which ranks second only to abacá as a cordage fiber, was subjected to several experiments but the results proved that it was not suitable. Jute butts were similarly tested and, while they gave better results than sisal, their use was, for the most part, restricted to an adulterant for old Manila rope, as it was found that they lacked the required strength. In 1902 and 1904, which is either shortly before, or shortly after, the time covered by the above tests, the Bureaus of Agriculture and Science of this Government were conducting extensive experiments in the manufacture of paper from abacá waste. The results here, as well as in the United States and Europe where samples were forwarded and similar experiments made simultaneously with those conducted here, were at the time thought to be so encouraging that it was only a short period afterwards that paper manufacturers in the United States began to place orders for small quantities of this waste in order to conduct more exhaustive tests. The ultimate result of these tests confirmed the preliminary ones in that the waste was suitable for the manufacture of Manila

paper, but the percentage of pulp from it was lower than that obtained from old Manila rope, and consequently the price offered for the former was entirely governed by that of the latter.

Thus the preparation and exportation to the United States of abacá waste for the manufacture of Manila paper began, practically speaking, in 1905 and continued until the end of 1911,[1] during which period considerable quantities were shipped, running at times as high as eight thousand bales per month. The cost of this waste to the manufacturers, laid down in New York, has been as high as the value of old rope, which means that it has been used all this time at a considerable loss to the manufacturers, who bore the loss this long in the hope of building up this new industry to such an extent as to encourage a more general production and the ultimate installation of the necessary machinery for reducing the waste to pulp here in the Islands in order to save the excessive freight and other charges on the raw-material from Manila to New York. All efforts directed toward the realization of this hope were thwarted, however, for experience and continuous trials have revealed many difficulties that proved impossible of solution. These difficulties are briefly the following:

First, as mentioned before, the percentage of paper pulp from the waste is lower than that obtained from old rope, and, therefore, it would be impossible to continue paying the same price for the former that is paid for the latter.

Second, the quality of the waste has been found to be extremely variable, depending on the quality of the commercial fiber produced in the same locality. In all the provinces where transportation and other necessary facilities can be obtained, the quality of the waste is very bad, owing to the inferior grades of the commercial fiber produced there.

Third, owing to the difficulty of drying the waste during the rainy season which covers the greater part of the year in most of the abacá districts, to the cost of transporting it to a provincial shipping port, to the cost of baling at the latter place and freight charges to Manila, and also to the freight and other charges connected with its shipment from Manila to New York, the cost of the waste to the manufacturers was prohibitive.

During the last year the provincial buyers paid from 4 to 5½ centavos per kilo, and they themselves received for it in Manila

[1] It is possible that abacá waste is still being produced, but, if so, it is only on a small scale, pending the outcome of recent developments mentioned later on in this paper.

an average of about 7 centavos. The cost of the same laid down in New York ranged from about 10 to 13 centavos per kilo, or about the same as old Manila rope. Thus it is plain that all parties concerned in the transaction either lost or were left with a very narrow margin of profit that hardly justified the trouble. Thus the abacá-waste industry, which began six or seven years ago with good prospects, ended in failure in spite of the liberal application of the necessary tests and inducements.

The experience gained in the attempt to build up the abacá-waste industry tended to strengthen the belief of the paper manufacturers in the suitability of the abacá fiber rather than to weaken it, and, as a result of this belief, we are pleased to note a recent development in the utilization of the abacá fiber, which is destined, on the one hand, to solve the difficulties encountered in the preparation, drying, and transportation of abacá waste, and on the other, to supply enough quantities of the raw material which, combined with old Manila rope, may prove sufficient to meet the increasing demand. We refer to the new "crusher" introduced by Mr. G. D. Adams, vice-president of the Cleveland Akron Bag Company, of Cleveland, Ohio. Mr. Adams represents the International Purchasing Company, which is formed by the leading paper manufacturers in the United States, and he is capably assisted here by Mr. H. B. Pond, manager, The International Purchasing Company, in this city. Three crushers of different sizes and capacities have already been introduced and are intended for trial operation in localities where abacá is extensively grown.[1]

This space does not allow of a full description of the construction and operation of this new machinery; besides, it is more advisable to wait until more elaborate tests have been made and the results more definitely demonstrated. It suffices here to say that these crushers handle the entire abacá stalks in exactly the same manner as sugar cane is handled. The crushed fiber and pulp come out fairly dry and are lifted up 10 or 15 meters and then dropped into an ingeniously constructed drier where in two or three hours the crushed material becomes so dry that the pulp can be easily shaken away from the fiber. The writer witnessed one of the trial operations of this new crusher and drier in this city and believes that the results were entirely

[1] It has been learned since that the largest crusher has been installed in Albay Province and is expected to be placed in operation in a short time.

satisfactory and encouraging. It is the intention of the above company to install these mills in those localities where, owing to the unsatisfactory growth of abacá and to the unwillingness of the planters or laborers to turn out good grades of the fiber, very low profits, if any, are now being realized. There it is believed the abacá stalks can be bought cheap and the planters will, at the same time, make higher profits from their plantings by selling the entire stalks than they are at present making by preparing the fiber the way they do. This, it is also hoped, may stimulate the abacá industry by forcing out of the market those inferior grades for the existence of which there can be no reason or excuse.

It is earnestly hoped that the abacá planters in the localities where the above machines are to be installed will coöperate in giving a fair chance and encouragement to this new phase of the abacá industry, trusting that the results will prove beneficial to all parties concerned.

NOTE.—The above article was submitted in July, 1912.

SELF-STERILITY OF THE SCUPPERNONG AND OTHER MUSCADINE GRAPES.

By P. J. WESTER, *Horticulturist.*

Notwithstanding the great number of excellent fruits grown in the Philippines, many residents from the Temperate Zone frequently inquire if the fruits to which they have been accustomed at home can not be grown here—among others the grape.

Grapes, *Vitis vinifera* L., were long ago introduced by the Spaniards and as a "survival of the fittest," a pale-green variety with small bunches of fruit is being grown to some extent in Cebu and is also found in Negros, Siquijor, and in several towns on the north coast of Mindanao. Grapevines are also found in Manila, and probably in other parts of the Archipelago.

While there may be some varieties of vinifera grapes that may become acclimatized in the Philippines it is probable that the Muscadine grapes, *Vitis rotundifolia* Michx.—the climate of whose home more nearly approximates that of the Tropics than does the climate of the home of the European grape—are likely to succeed better here than the European. In anticipation of the introduction of several of the best varieties of the Muscadine grapes which has been arranged for by the Bureau of Agriculture, the experience had with the Muscadine grape, in southeast Florida, in a climate similar to that of the Philippines, may not be without interest. There numerous varieties of the American, European, and Muscadine grapes have been tried repeatedly. In general the varieties of the American grape have been most disappointing, and practically all the European varieties have been failures, but the Muscadine grapes that have been tried, such as the Scuppernong and Thomas, have made an exceedingly satisfactory growth.[1] However, they proved to be very unfruitful and for want of a better reason, the climate and soil were blamed. Judging from the results

[1] *Vitis rotundifolia* Michx. is indigenous to South Florida.

obtained by F. C. Reimer and L. R. Detjen at the North Carolina Agricultural Experimental Station, in their observations and experiments relative to the pollination and fertilization of the flowers of the Scupperong, Thomas, and several other varieties of Muscadine grapes, summarized in Bulletin No. 209 of the station, the primal reason for the unfruitfulness in the Muscadine grapes would now seem to be self-sterility.

The work of Reimer and Detjen included: Germination tests of pollen; microscopic study of pollen; study of the structure of the flowers; study of the influence of male vines on the crop growing in close proximity to the fruiting vines; and pollination experiments and bagging tests.

In the pollination experiments pollen from the Scuppernong and the James was applied to stigmas in flower clusters of the Scuppernong with the result that no perfectly formed berries developed, proving that the Scuppernong is self-sterile and also that pollen from the James variety, typical of the other Muscadine grapes, is ineffective on the Scuppernong. In the germination tests of pollen of thirteen varieties of Muscadine grapes and several wild fruiting vines of this type, pollen in no instance germinated; pollen from male vines, similarly treated, germinated well in three to four hours.

The germination tests, as well as the observations made in a microscopic study of the pollen, combined with the results obtained in the bagging and pollination experiments, show that the pollen of the Muscadine grapes examined, Scuppernong, James, Thomas, Flower, Mish, Memory, Flowers Improved, Hopkins, Tenderpulp, Luola, Labama, San Jacinto, and San Melaska, is worthless and these varieties are, therefore, self-sterile. As a result, interplanting of these varieties will *not render them more prolific.* Their productivity can be increased provided soil, climatic and cultural conditions are favorable *only by planting among them, or in their close proximity, male vines.* The value of male vines growing near the fruiting sorts was strikingly illustrated in the course of this investigation; in one instance, in a Scuppernong vineyard in which there grew male vines, the yield was *five times greater* than in another vineyard on the same farm that contained no male vines. It was also noted that honey-bees and certain flies are active as pollinizers.

In order to make the planting of male vines effective near the cultivated Muscadine vines, care should be taken, of course, to see that the two vines flower at the same time. Those who

are familiar with the structure of the flowers of the grape, may, where the Muscadine grape grows wild, obtain material during the flowering season for interplanting from wild male vines which occur in the hammocklands; in other countries male vines must be obtained from someone who has them for sale.

The different varieties of Muscadine grapes would be distinct and welcome additions to the cultivated fruits in the Philippines and they are very likely to succeed here. Those who may contemplate their planting should, however, not forget to also plant a few male vines in the vineyard.

THE BICOL FARM.

By E. H. Koert, *Agricultural Inspector.*

Soon after the arrival of the representative of the Bureau of Agriculture in Virac, Catanduanes Islands, on January 11, 1911, it was found that the keeping of stallions and other animals for breeding purposes within the limits of a town or village was at the best a very unsatisfactory arrangement. The conditions making it so were principally expense, poor stabling, lack of proper exercising and working grounds, and the difficulty of securing grass. The only remedy was the establishment of a small farm by the combined efforts of the three municipalities of Virac, Bato, and Calolbon which constitute the southern part of Catanduanes Island. The matter was discussed with a number of the leading citizens of Virac and a plan was formulated which was then submitted to several persons from the towns of Bato and Calolbon and upon having met with their approval it was adopted. This was that the towns of Bato and Calolbon were to furnish the necessary funds while Virac's share was to be given in labor and materials. For securing the necessary appropriations in Bato and Calolbon the principal credit is due Messrs. Eusebio Tejada and Capt. Braulio Tapular, respectively.

The land to be purchased not possessing a Torrens title, considerable difficulty was encountered in securing the necessary approval for the expenditure of municipal funds, but the whole matter having been laid before the Governor-General on the occasion of his visit to Virac, October 1, 1911, His Excellency approved of the project. Approval once secured, arrangements were made for the construction of the stable. During the month of November, 1911, the work was started and New Year's Day, 1912, witnessed the occupation of the farm. In connection with this it is desired to say a few words in appreciation of the assistance given the writer by various residents of Virac. The president of Virac, Sr. Margarito Surtida, did yeoman service in securing the necessary materials and labor for the construction of the stable; the vice-president, Sr. Pedro Alberto, gave

his services in the supervision of the construction work; Sr. Eustaquio Joson rendered invaluable services in holding meetings in the various barrios to secure the prompt furnishing of materials and the attendance of laborers. Still another, Sr. Isidro de la Hostia, has at all times shown a helping hand and only recently donated a small strip of land in order that the farm might be rectangular in shape.

During the month of July, 1912, a representative of the Bureau of Lands surveyed the farm and found that it contains a trifle over $2\frac{1}{3}$ hectares.

For lack of authority to employ sufficient labor but little progress was made until March 31, 1912. Then the fencing was begun and pushed until the whole plot was enclosed by a stake fence, the only kind that could be built with the limited funds available. The necessary stakes were cut on the farm and on adjoining land.

In the meantime some guinea-grass roots which had previously been received from Manila and planted were transplanted to the first land cleared. As soon as another patch was cleared cowpeas and corn were planted. The numerous carabaos at pasture nearby have so far destroyed three crops of corn by breaking down the fencing at night. It has nevertheless been possible to raise sufficient cowpeas to have not only considerable for use but enough to distribute in small lots. They are greatly appreciated by the people and withstood the long dry period nicely. On account of its habit of growing continuously, the cowpea has locally received the name "La habichuela aprovechable."

Since the rains have set in the plantings of guinea grass have been extended until nearly half a hectare is planted to it. Not only have the horses had their daily ration but it has been possible to furnish roots in small lots to a large number of people.

Some small progress in the introduction of vegetables has also been made. Instead of furnishing seeds to the people direct the following policy has been adopted: A stock of seeds being on hand practically all the time, these were distributed to the teachers with the understanding that the seeds were to be planted in the seedbeds of the school gardens and the plants grown were to be available to anybody in the district asking for them, thus avoiding the loss of seed that generally results from lack of knowledge in securing proper germination, etc. The "Roselle," but recently introduced by the Bureau, has already won fame

in this island, being greatly appreciated as a salad plant, and its further benefits and uses may become known to the people through the domestic science class of the subprovincial school. Since the opening of the school a small plot has been turned over to the barrio school near the Bicol Farm and a model garden has been laid out by the students under the direction of Mr. Antonio Amata who had excellent results last year in raising vegetables and also in the manufacture by his students of agricultural instruments.

Some work in the way of horticulture is also being taken up and it is hoped that before the rainy season is over satisfactory progress may have been made.

Above all the principal object in the acquisition and improvement of the farm was, to provide better conditions for breeding stock, and to provide facilities for the people so that they might leave their animals at the farm for breeding and treatment. The pasture, although in poor condition till lately, has recently been planted to Bermuda grass and this promises to do exceptionally well under local conditions. The pasture has been of great benefit and help as a place for keeping the numerous horses that are being castrated, it being possible to leave the animals on the farm for a day or two with no extra labor to speak of and without causing expense to the owner.

115489——3

AGRICULTURAL CONDITIONS IN BOHOL.

By E. F. SOUTHWICK, *Agricultural Inspector.*

GENERAL FEATURES.

The Island of Bohol is to a great extent of coral and volcanic-rock formation. The soil for the most part is clay, varying from a "gumbo" in the southern end of the island to a sandy loam in the northern part. From Mabini to Inabanga by way of Tagbilaran a range of hills follows the coast and extends inland to the towns of Bilar and Batuan where the country stretches out into a level plain, including the towns of Carmen,

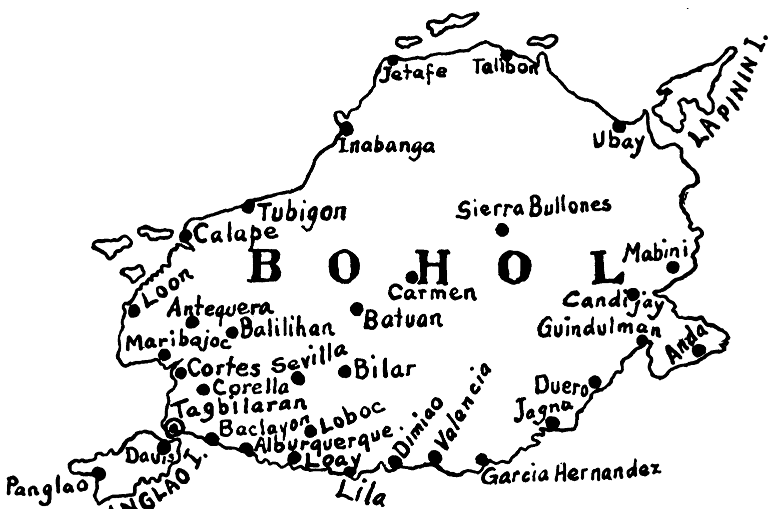


Fig. 6. Map of Bohol.

Sierra Bullones, Ubay, Talibon and Getafe, broken only by a small range of hills extending from Mabini to Talibon. A great portion of the mountain region is rocky and rough, but even here are found many fertile valleys small in area, but capable of producing good crops.

One of the finest sections of Bohol now under cultivation is between the towns of Tubigon and Calape. It is some seven

kilometers in length and not over 3 kilometers at the widest place. It is here only that sugar cane is raised to any considerable extent. The northern plain in the vicinity of Ubay and Talibon is given up entirely to stock grazing. The central plain around Carmen and Sierra Bullones, which is perhaps the most desirable agricultural land of Bohol, is entirely undeveloped on account of being inaccessible.

Very little advance has been made as yet in the use of modern tools or practices and the native plow undisputedly holds the center of the stage in agricultural operations. On only one farm has the writer seen modern implements in use.

CORN.

Corn is grown very generally throughout the island and constitutes the principal food of the people. Inabanga and the surrounding country takes the lead in the production of this crop. It is grown both on the hill-sides and the plains, and in fact on all cultivated land that is not particularly suited to rice growing. Three crops a year are harvested, provided the year is a normal one. The quality of the corn is good as corn runs in this section of the island.

The method of preparing the land and of cultivating the corn is practically the same as that followed in other parts of the Islands. The soil is generally plowed once or twice with the native plow then furrowed and planted. This is not always the case, especially if corn is to follow palay, when the stubble may not be turned under but furrows simply made and the corn planted; this is also done where corn follows corn, not even the stalks of the former crop being cut down, though this practice is not common. The cultivation after the crop is up varies from one to three times, being done with the plow and usually carried to the same depth as an original plowing. The number of cultivations depends chiefly upon the growth of the weeds. If the weeds grow rapidly then the crop gets a greater amount of cultivation. Where a carabao is not to be had or where it is impossible to work such an animal the bolo is used for cultivating the crop, and in difficult places, even for preparing the land for planting. In the preparation of the soil a bar is customarily used on such land.

The seed for planting is usually taken aimlessly from a pile of shelled corn, and seldom is any attempt made at selection. In some cases only kernels with a large chit or germ are selected. From three to five kernels are planted to the hill, and the hills

are approximately a meter apart each way. In very few instances can a farmer be found who does not go over his field and replant all missing hills. Thinning is not practiced, and although this is an important feature it is less so than replanting. The custom of eating "roasting ears" and boiled corn is a hindrance to good seed selection, especially in a season like the present when the people are depending upon this for food. The ears chosen for this purpose are those first to mature and of greatest size, which would be the ones selected for seed at a later date. This would not be true to such a degree where a man had several hectares planted to corn, but is true with the small farmer. There are sections here where the corn is mixed to a large extent with both red and yellow varieties.

In spite of the fact that 25 per cent more corn was planted in June and July than is usually planted and that the past season has been a good one, the crop was practically a failure. This was due to the vigorous attacks of a large swarm of locusts that has been moving about since the first of June. In many towns the entire corn crop was wiped out, while in other places the damage amounted to not over 20 per cent. Certain sections have been planted three times without results.

RICE.

Rice is grown as generally throughout the province as corn. This is made possible by the large number of small streams that are found here. These streams although usually dry during a drought are used along their entire course during the rainy season to irrigate rice paddies. The paddies are small in area and constructed in terraces so that the water flows from one to the other. Many of the fields are poorly irrigated and depend almost directly upon the rainfall for water. Such paddies are often severely injured by a short drought, or as was the case during the present year, by locusts, which will not touch palay when flooded but make short work of it when dry.

The preparation of the soil before the palay is planted is very thorough and could the farmer be induced to prepare his corn field in a like manner the resulting crop would tell a very different story. All work is done while the paddy has enough water on it to cover the ground. The soil is first plowed and then several carabaos abreast are driven over and over it until a thin soft mud is produced. Much care is taken to have all the edges and corners in as good condition as the middle. After a thin soft mud is obtained a bamboo harrow is used followed

by a sort of plank leveler. These are dragged around and around until the ground is perfectly level throughout so as to facilitate an even distribution of water.

The seed is planted very thickly in drills on dry soil, often between rows of corn, and when it attains a height of 10 to 20 centimeters it is transplanted by hand to the paddies. In transplanting the leaves of the plants are cut back. Where a large area of paddies is to be planted several sowings of seed are made so that the plants will be right for transplanting as the fields are ready. Soon after the plants have become well established they receive the only cultivation which they get. This is done by stirring the soil around the plants with the hand or bolo.

The best irrigation system on the island is in Lila. This consists of a considerable area of land irrigated by water obtained from a constantly flowing spring in the hills.

TOBACCO.

Tobacco is not as important a crop here as it should be. Much of the leaf that is used in the island is imported. Inabanga produces a larger amount than the remainder of the province. It is claimed that in most towns it is not only difficult to produce, but the flavor of the leaf is not liked by the people.

SUGAR CANE.

With the exceptions of the towns of Tubigon and Calape very little sugar cane is produced in Bohol for the market. Nearly every town has a few hectares, but this is for home consumption only. In Tubigon there are two modern mills while the others are of the old two-roller, carabao type.

The 1912 crop is reported to have been at least 50 per cent less than an average yield, due to the drought. For this same reason almost no new plantings were made. Although the fields started up well after the rains of July they have been greatly damaged by locusts. In a few cases this will prove fatal and will cause a severe set-back and a reduced yield in 1913.

COCONUTS.

Coconuts are found in all parts of the province excepting the extreme interior where the number is very limited. The most extensive cultivation is found along the south coast, and here many of the towns get their chief income from the coconut tree.

Copra and tuba are the principal products, the latter finding a home market while the copra is bought by local agents and goes

to Cebu. Very little of the copra is dried over a fire, most of it being cured in the sun on native mats or burlap.

The coconut trees in many parts have been severely damaged the past year by both the drought and the locusts. Where the soil was shallow much greater effects were noted than where the soil was deep and more moisture available. In certain sections the people have been forced to eat the tender shoots of the trees, in this way destroying many. This together with those destroyed by the dry weather will cause somewhat of a decrease in the number of bearing trees. Many trees were also fruitless up to the time they felt the effects of the July rains when they flowered and set fruit.

New seedlings are constantly being planted in increasing numbers so the outlook for this industry is very bright at present.

ABACÁ (Manila Hemp).

Abacá is cultivated most extensively in the towns of Gindulman, Tubigon, Candijay, and Bilar. It is grown mostly on the hillsides and receives little or no cultivation. In spite of this fact mulching with the leaves is practiced very generally. No attempt is made at selection and far from the proper results are obtained. The stripping is done entirely by hand.

MAGUEY (Cantala).

This is a plant that is slowly losing its foothold in Bohol, due entirely to neglect. The plant does well in all parts of the province and there is no reason why it could not be raised with profit in many sections of the island, as the only attention maguey receives is to cut the leaves when they are mature enough for that purpose. The fiber is then removed by the "retting" system, which consists of stripping the leaves and placing them in salt water until the pulp softens. After this the fiber is separated by being beaten out with a piece of wood.

FRUIT.

Bananas, mangos, and papayas are grown throughout the province, Dauis and Panglao furnishing the best and largest quantity of mangos. Chicos and pineapples are produced only in limited numbers. Citrus fruits are very little grown as are also all other fruits. Guava is found wild in all sections but no attention is given to its cultivation.

VEGETABLES.

Camotes are produced in greater quantities than any other vegetable. Large areas are planted to this crop, especially this

season when fields of corn destroyed by locusts were immediately planted to camotes. In many instances they are set out in corn fields as soon as the corn has become well started. Besides being greatly relished by the people this plant is not attacked by the locusts. Mungos are raised to quite an extent in certain localities, but are usually planted among the corn and given little attention. On account of the scarcity of food considerable camoteng-cahoy has been set out. Ube, gabe, pao, tomatoes, and peppers are found almost everywhere in limited quantities. The high price of rice and lack of corn together with the locust pest caused more vegetables to be planted than is the general practice.

LIVE STOCK.

Cattle and carabao are found in fairly large numbers in the towns of Mabini, Ubay, Talibon, Getafe, and Sierra Bullones. Here are large areas of fine level grazing land supplying an abundance of the finest green forage. Many animals are shipped from these towns to neighboring islands. The protracted dry period caused the price of animals in these parts to drop off 50 per cent. Cattle are slowly finding their place as work animals and are sure to become recognized as such. The farmers who have tried them claim they are superior to the carabao in that they will eat dry fodder, such as dried corn and cane tops, and do not have to be taken to the water as do carabao. Besides this they are better in handling and accomplish more work. Horses are found in fairly good numbers but no thought is given to breeding, so little or no improvement is being made.

TRANSPORTATION.

The facilities for transportation in the Province of Bohol are of the poorest. The only practical means at the present time is by water. From Tagbilaran north to Tubigon there is a good road consisting of about equal parts first and second class. To the south from Tagbilaran to Gindulman there is also a good first and second class road broken at Loay by a bamboo bridge over the Loboc River. Heavy loads are not allowed to cross this bridge thus preventing heavy traffic in this direction. Everything carried to and from any of the interior towns must be "packed" by men. This utter lack of dependable transportation makes it impossible to ship products from place to place within the province. Now that the Tubigon–Carmen Road is an assured fact, one of the best agricultural districts of the island will be opened up in a very few years.

CURRENT NOTES[1]—JANUARY.

NOTES BY P. J. WESTER, Horticulturist.

AVOCADO OR AHUACATE.

We are in receipt of a very interesting pamphlet on the avocado by Mr. R. W. Popenoe, being a reprint from The Monthly Bulletin of the California State Commission of Horticulture. The author discusses the avocado with particular reference to the possibilities for this fruit in California. The part devoted to the propagation of the avocado is particularly timely. The statement that "lopping a young budded tree is dangerous" would seem to be somewhat overdrawn. It is true that the young avocado is more brittle than the citrus trees but this brittleness can be readily overcome with a little care in lopping the plants. In fact this has been used with good success by the writer in his fairly extensive experience in propagating the avocado.

We regret the necessity of having to take exception to Mr. Popenoe with reference to his proposal that the name "ahuacate" be substituted for the avocado. We admit that the word "avocado" is "reeking" with corruption, but we fail to see that "ahuacate" is either more beautiful, more euphonious, or more expressive of the flavor of the fruit. Were priority alone to be considered, the fruit in question has just as much claim, or even more, to the old Peruvian name "palta;" avocado is already in general use, however, and is near enough to the Aztec "ahuacate" to recall the connection—if that is necessary.

Next to being attractive and euphonious the points to receive consideration in adopting or coining a horticultural name for a plant should be those of the spelling and pronunciation of the name, about which there should be a minimum of doubt, and then as far as possible let priority rule. Both the American Pomological Society and the Florida State Horticultural Society have officially adopted the name avocado, and all recent publications of importance dealing with the subject refer to the fruit by this name. We doubt that it is good policy to try to switch off to another name now, in fact, we doubt if it can be successfully done.

[1] Original notes prepared by various members of the Bureau of Agriculture.

CANNED PINEAPPLES.

The following quotation from the Daily Consular and Trade Reports should be of interest to those who are engaging in pineapple growing and canning in the Philippines:

A firm in Germany informs an American consular officer that it is in the market for Hawaiian pineapples, or possibly the Porto Rican product in the event that the Porto Rican planters are in a position to pack their fruit for the trade. The fruit comes packed in cases of 24 and 48 cans, each containing one whole pineapple and of gross weight of 2½ or 3 pounds (1.13 to 1.35 kilos). The contents should be preserved in their own juice—that is, cooked without sugar—in order to enter at 4 marks (₱1.90) per 100 kilos. At present pineapples packed as above are received in the Hamburg free port, where the contents of the cans are emptied into barrels and the full barrels are thereupon passed through the customs. Under these circumstances it is not necessary to put fancy labels on the cans. The firm proposes to establish a bank credit at the place of shipment against which shippers can draw on the deposit of shipping documents.

ATMOSPHERIC NITROGEN AS A FERTILIZER.

Not so many years ago some of the world's foremost scientists scared us with the prediction of a nitrogen famine, and the rapid exhaustion of the world's supply of available nitrogen was a source of great concern. It was not long, however, until it was discovered that atmospheric nitrogen could be fixed by means of the electric arc and thus an inexhaustible storehouse was thrown open, so to say, to a famine-threatened humanity.

Soon the methods of the fixation of atmospheric nitrogen were improved upon and cheapened until it became possible to produce it in large quantities to compete with nitrate of soda and sulphate of ammonia. Norway leads in the manufacture of this new fertilizer, known as cyanamide or nitrolim, and if the plans of the Norwegian Hydro-electric Nitrogen Company mature, by the close of 1916, waterfalls in Norway to the enormous total of 540,045 horsepower will be utilized in the manufacture of nitrolim.

THE COLONIZATION OF SIBERIA.

Everybody knows of the emigration from Europe to the United States and Canada, and most well-informed people are cognizant of the emigration to South America, South Africa, and Australia, but few realize the extent of the colonization of Siberia which is taking place directed by the Imperial Government of Russia.

From January 1 to May 14, 1912, 144,265 Russian colonists entered Siberia. In 1911, during the same period, the immigrants numbered 127,000. The number who returned to European Russia during these periods was 69,997.

The department of agriculture and land settlement has recently worked out a detailed plan for the drainage of 24,000,000 hectares in the vicinity of the Amur River Railway.

THE COST AND PROFIT OF GROWING SUGAR CANE IN CUBA.

The following statistics relative to sugar cane growing in Cuba culled from the Agricultural News of Barbados should prove interesting to the cane growers in the Philippines. These statistics relate to the cost of preparing and cultivating one acre[1] of cane land per year.

Preparation of land.		
Clearing land for plowing, from	₱3.00 to	₱20.00
First plowing, from	8.00 to	12.40
Second plowing, from	5.40 to	6.00
Harrowing, from	2.00 to	2.50
Cleaning and marking, from	2.50 to	3.30
	20.90	44.20
Cost of planting.		
Seed cane, from	₱8.00 to	₱10.00
Hauling, from	1.00 to	1.40
Cutting seed-cane, from	1.00 to	1.60
Distribution of seed-cane, from	5.00 to	7.00
Covering, from	6.00 to	7.60
	21.00	27.60
Cost of cultivation.		
First cultivation, from	₱8.00 to	₱9.00
Second cultivation, from	5.50 to	6.20
Third cultivation, from	3.20 to	4.00
Three cleanings, from	4.40 to	6.00
	21.10	25.20
Harvesting.		
Cutting, from	₱25.50 to	₱36.00
Hauling, from	18.00 to	36.00
	43.50	72.00
Total	106.50	169.00

The cane needs replanting every six years and with the cost of cultivation reduced to ₱160 per acre per year during the five years subsequent to the first, the net profit to the grower in six years is ₱352.60, or ₱58.75 per year per acre, or ₱146.90 per hectare.

[1] 1 acre = 0.4 hectare.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

CASSAVA FOOD PRODUCTS.

Few people in the Philippines realize the great possibilities of the cassava crop here. To be sure, it has long been cultivated under several varieties throughout the greater portion of the Archipelago, but either the varieties are inferior or more frequently, perhaps, the attention given the plants is such that a good crop of roots is seldom obtained.

Until the great rubber boom came into the Malay States, cassava was for many years a very profitable crop in some districts and even now there is a large acreage in this plant near Penang.

In South America, of course, the plant is of much greater account and in some countries, like Colombia and Brazil, it forms a very large part of the daily ration of the middle and lower classes. In Jamaica a new industry has recently sprung up in the line of making cassava wafers which are now exported to the United Kingdom and the United States. These wafers are made in several forms from the huge, coarse, "Bammies," consisting of the grated root with a little of the starch pressed out, made into thin sheets and toasted, or roasted, or fried, to the delicate "tea wafers" which for some time have been used at fashionable luncheons and afternoon tea-parties, especially in Boston. Nowhere is there anything else in the bread line quite so good, in my opinion, as hot buttered "bammies" fresh from the fire.

Not only the wafers, cookies, and cakes, but also the new breakfast foods, tapioca, flour, etc., made from the grated root treated in different ways, are bound to be popular; likewise the various kinds of sauces made by boiling down the juice from the grated roots, with or without salt and spices, etc. Of these latter, "cassareep" and several sauces like "Worcestershire" are now on the market not only in the West Indies but to some extent in Europe and America; these condiments possess the property of rendering meats very digestible and appetizing; they undoubtedly have a direct effect on the stomach itself, and in the near future will be appreciated very highly by threpsologists as well as cooks and housewives.

RATS IN COCHIN CHINA.

Cochin China, according to the American Consul at Saigon, is suffering very severely from rats in the palay fields. The average loss from this pest in some districts is as high as 30

per cent of the normal crop. Reckoning the average export at over 1,000,000 tons of commercial rice valued at not less than sixty million pesós, we are brought face to face with the terrifying figure of six to ten million pesos direct loss per year from these rodents. The rats belong to three distinct subspecies, no one of which seems to be found in the Philippines—although the Philippine rats now number over forty distinct varieties and species. In Cochin China poisons have not been very successful but in the Philippines a fair amount of success has usually resulted from the use of arsenical baits. The loss from rats in the Philippines is very severe but probably nothing like the 25 per cent or more of our neighboring country.

CHICK PEAS.

The East Indian gram, or chick pea, is gaining great favor in certain sections of Europe as a stock feed. It can be imported for about the same price as American maize and is said to be a little better feed. In Denmark, for instance, the importation seems to be above 40,000 tons per year. The Mexican tableland produces this crop to perfection and in certain districts of India it succeeds very well except during the rainy season; in the Philippines, however, it is practically impossible to grow it. The comparatively few tons imported into the Archipelago are consumed very largely by the Spanish residents. Properly cooked, there is, perhaps, no better leguminous grain for the table than the "garbanzo."

DRIED MANGOS.

The bureau of agriculture of the Mexican department of fomento is succeeding with mango-drying tests which are being made at the agricultural experiment station at Tapanatepec, in the State of Oaxaca. The nearly ripe mangos are cut into slices, dried in the sun, and the product is then packed in small wooden boxes holding one or two kilos; the layers are kept apart with mango leaves. It is said that the fruit keeps a long time and that the demand is increasing.

COCONUTS IN BRITISH GUIANA.

The department of science and agriculture of British Guiana is endeavoring to put the coconut business of that country on a firm and very modern basis. The April number of the Journal of the Board of Agriculture of British Guiana contains a very interesting article on the cultivation of coconuts, most of

the ideas brought forward being absolutely in harmony with those of our Bulletin 17 and the Coconut Number (May, 1912) of the AGRICULTURAL REVIEW. Though artificial driers are thus far not much in evidence, considerable attention is given that subject. In British Guiana it seems there are even more insect pests of the coconut than we have in the Philippines, and furthermore the budrot is a constant menace to planters there.

Messrs. J. B. Harrison and F. A. Stockdale are the authors of this article; Mr. Stockdale has had a wide experience in tropical American coconut culture and the fact that he does not disagree with any of the ideas put forward by this Bureau in that line is worthy of note for, although South American conditions differ in many respects from those of the Philippines, the culture of the coconut is held to be practically the same in all countries.

BEEF INDUSTRY IN SOUTH AMERICA.

In the so-called River Plate district of South America, i. e., in the countries of Uruguay, Paraguay, Argentine, and Brazil, no less than 1,317,100 head of neat cattle were slaughtered in 1911 for "tasajo," or jerked beef. To this number may be added 356,100 head slaughtered for meat extracts and preserved meats. The increase in the number of modern packing houses predicates the disappearance of the old-fashioned "saladeros," or jerked-beef plants; it is a question whether this change in the enormous beef industry of that part of the world will soon affect the price of canned meats in the European and Oriental markets.

By the way, a 77 page bulletin on the canning of foods has recently been issued by the United States Bureau of Chemistry's laboratory at San Francisco, California.

The present number of cattle in Argentina is above 28,000,000 head.

DRIED FRUITS IN CALIFORNIA.

In 1911 the output of dried fruits in California, according to the California Fruit Grower, was over 197,000 tons; the bulk of this figure is represented by prunes, 95,000, and raisins, 65,000 tons.

IS THE ARAB HORSE PASSING?

In Cairo, Egypt, there is now being instituted an international society for the preservation of the pure Arab type. This breed has been used to such a remarkable extent for crossing with other breeds, not only in Europe but even in India and

various countries of northern and north central Africa, that it is said to be now a rather difficult matter to find an absolutely "pure-blooded" Arab outside of limited areas like the Arabian and Syrian deserts where the Bedouin tribes are jealously guarding a comparatively small number of these valuable animals. In Asiatic Turkey, Algeria, and the Sudan, it appears that there has been a considerable infusion of various alien breeds, so that, although the horses are popularly known as pure-bred Arabs, the hippologists could find some fault with this statement.

From the Agricultural Journal of the Union of South Africa we learn that that government recently sent an expedition into Northern Nigeria and thence across the border into the French Sudan in a search for new breeds of ostriches, and incidentally two fine stallions of the rare Asben breed were brought back. This expedition traveled up the Niger River for six days, then by train to Kano near the Sudan boundary of Northern Nigeria; from that point the expedition started overland with ninety-four carriers into the Sudan wilderness. Some 800 kilometers north of Kano the party came upon the strange race of Tuaregs, who are said to have descended from the Saracens who fought in the Crusades during the time of Richard Cœur de Lion. The Asben tribe of these people inhabits the hilly district of Air, a sort of island in the vast Sahara Desert, isolated by 400 kilometers of sand wastes stretching in every direction; they are very carefully striving to maintain their breed of horses absolutely free from other breeds and they claim that the Asben horse is far superior to the ordinary Arab, even declaring that the former animal can cover as much ground in one day as the Arab will in four! It seems that the Asben, or Air, breed is found in two varieties, the black and the white; a specimen of each type has been brought back to South Africa where it is hoped great benefit will result to the horse breeders of that part of the continent. It is stated that the Tuaregs, or Taureks, are most treacherous and bloodthirsty and the expedition frequently had to run very grave risks, to say nothing of the hardships and privations in obtaining these stallions.

In passing it may be well to note that the Arab blood is now recognized as an important element in the following breeds of Europe: Boulonnais and Percheron of France; Orloff, Strelets, Cossack, and Rastopchine of Russia; several types of Hungarian horses; the Anglo-French-Arab cross-breeds; and, of course, the English thoroughbred.

No one can say what another half century of thrematology will bring forth in the horse line, but up to date the Arab breeds are assuredly the most perfect and most aristocratic horses the world has been blessed with. Why? Because, as the Arabs, who almost worship them, say, "Allah *made* them so!"

SOME UNUSUAL ANIMAL PRODUCTS.

Although Florida, California and recently Australia, are beginning to realize that there are big profits in ostrich raising, the real center of the business always has been—and probably will continue for a long time to be—Cape Colony. Here ostriches are bred as carefully as horses and the best and most successful "feather growers" are as proud of their pedigreed studs as the average American or European animal breeder. When it is possible to raise birds worth ₱1,000 to ₱2,000 per pair on alfalfa, which costs practically nothing, and to pluck from such birds feathers which actually do sell for from ₱1,000 to ₱1,500 per kilo, the wonder is that so few men are in the business.

China consumes about one million pesos' worth of trepang per year. The Philippines export, mostly to China, about one-tenth of this quantity. Under proper management and with first-class agencies in the Chinese ports, this business could undoubtedly be trebled within two years. Several distinct varieties of these "sea cucumbers" occur abundantly about the southern islands of the Archipelago.

There seems to be no doubt that the world has a strong oil hunger, or shall we say, thirst. Notwithstanding the tremendous increase in Europe's copra imports—now about 2,000 tons per day—besides the 200,000 tons or so per year of peanuts from Africa and India and a similar quantity of oil-palm nuts, the price of whale oil is still so high that that industry throughout the world is "booming." For instance, in the Falkland Archipelago in the South Atlantic it is reported that at least 8,000 whales were taken last season, and this number is probably short of the true figure since there are a number of tramp whaling steamers which have no fixed base and which are satisfied with one whale per week; other large plants are located in the Crozets between Africa and Australia. The new factories at South Georgia, the Falkland Islands, and the South Sandwich group are running with a full equipment of fifty swift and powerful whalers and over 1,000 men during the season. This business extends up the west coast of South America and recently Brazil has become interested, while the Pacific Coast

of America, the Arctic Region and Japan are all putting in modern improvements to be able to meet the renewed demands for oil, meat guano, and bonemeal,—for not only the oil but also the bones and dried and ground meat, or "whale guano," are profitable products of the catch.

A warning note has been sounded, however, on account of the threatened extinctions of these valuable mammals by the too rapid rate of slaughter. Southeast Africa is beginning to realize that it will take only a comparatively few years more to practically exterminate the humpback whales on the east coast of that continent. The writer has seen several schools of twenty to fifty individuals each in the course of a day's sail off Mozambique, but when it is remembered that two or three whales (about one-third "cows") are caught every day at the whaling stations in that region, and when we consider that the humpback whale (*Megaptera longimana*) probably does not reach maturity before the age of fifteen years (the right whale requires twenty or more), we can easily "see the finish" of the industry.

It is possible that the largest whale ever recorded was recently reported as captured by the Corral Whaling Company, of Chile. It is said this mammal "measured 125 feet and yielded 100 barrels of oil;" about 28 to 30 meters (90 to 100 feet) is considered the maximum length of the North Atlantic whales. It is difficult to imagine the size of such an animal, but calculating the weight of the ordinary 10-meter humpback at 15 to 20 tons, a whale nearly three times the length of that species would weigh probably ten times as much.

By the way, this makes this South Pacific (presumably "sulphur bottom") whale the largest mammal the world has ever seen even in the geological epochs; even the old atlantosaurus reached only about the same length as this whale, and with its exceedingly slender neck and long tail, the body itself was probably only a few times the size of an elephant—which of course is not to be compared at all with the body of a 38-meter whale.

ANOTHER SHARK-INDUSTRY IMPETUS.

With the shark-fin industry of the Sulu Archipelago in mind, the following note by Vice Consul-General D. Milton Figart, of Singapore, which appeared some months ago in the Daily Consular and Trade Reports will be of interest:

> It has been proposed to start in Malaysia a small export trade in shark's-liver oil. This oil is refined in Europe and sold as cod-liver oil. In October the ocean sharks come into the lagoon, between the barrier

reef and the atolls, to pair. At this time they can be speared in large numbers by people skilled in catching them. There are several species of these sharks and they ordinarily run from 7 to 15 feet in length. The girth of an ordinary shark is the same as its length, and an 11-foot shark would be 11 feet around the body. The liver of a shark of this size gives about 5 gallons of oil. The oil brings $73 a ton. The sharks are found in pairs and the harpooners try to kill the male first, in which case they are able to also spear the female, as it does not desert its mate.

If a 3-meter shark, single and unattended, will yield 20 liters of high-grade oil from the liver alone, to say nothing of several pesos worth of fish guano, it should not be long before something is done to take advantage of the tremendous number of sharks around our southern islands.

ROACH-PROOF BOOK VARNISH.

Of the several so-called varnishes for protecting books, leather, etc., from damage by insects in the Tropics, the following formula is highly recommended, the author having successfully used it against roaches in one of the worst countries from that point of view in the world—Porto Rico.

Wood alcohol or strong vino	1 liter.
Carbolic acid, full strength	30 grams (1 oz.)
Corrosive sublimate	15 grams (½ oz.)

This mixture should be allowed to stand, after shaking, for twenty-four hours before using; it should be kept in a large bottle with a conspicuous "Poison" label, beyond the reach of servants and children. It should be applied with a bit of cotton tied to a stick or with a small paint brush. It should not be applied to soft leather nor to bright colored bindings. One application every six months is sufficient.

115489——4

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—OCTOBER, 1912.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos	7,350,841	3,171,657	1,097,457	11,619,955
	Value	366,646	139,885	42,541	549,072
Beef cattle	Numbers	520			520
	Value	15,862			15,862
Eggs	Dozens	320,179	186	207	320,572
	Value	26,826	15	29	26,870
Sugar	Kilos	255,206	53,330	20,484	329,020
	Value	20,678	4,540	1,606	26,824
Coffe	Kilos	76,136	1,727	2,169	80,032
	Value	24,771	550	750	26,071
Cocoa	Kilos	22,718	5,513		28,231
	Value	7,892	1,689		9,581
Raw cotton	Kilos				
	Value				

EXPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Hemp	Kilos	13,638,798	2,287,987		15,926,785
	Value	1,934,350	290,836		2,225,186
Copra	Kilos	14,679,696	2,623,983		17,303,679
	Value	1,535,398	260,070		1,795,468
Sugar	Kilos	6,385,526		30,208,152	36,593,678
	Value	292,403		1,386,693	1,679,096
Cigars	Thousand	14,978			14,978
	Value	239,430			239,430
Cigarettes	Thousand	4,673			4,673
	Value	5,963			5,963
Tobacco	Kilos	1,348,460			1,348,460
	Value	192,928			192,928

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

OCTOBER, 1912.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tárlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.8	-------	29.2	-------	28.2	-------	26.5	7.9	25.9	-------	24.2	26.6
2	27.9	-------	27.4	17.3	27.6	-------	26.9	25.7	25.4	16	26.8	8.7
3	26.9	-------	27.6	-------	26.9	-------	28	3.8	24.6	20	24.1	83.6
4	26.8	2.3	27.1	-------	26.8	-------	28.1	-------	25.7	7.3	26	-------
5	26.8	-------	26.4	14.2	25.9	3.6	28.2	-------	26.4	15.5	27.1	-------
6	26.4	-------	25.8	22.9	26.3	5.4	27.6	.3	26.7	-------	27.4	-------
7	25.1	24.1	25.8	19	26.3	6.4	28.2	1.5	26.4	30	27.4	-------
8	25.6	.3	26.9	9.1	26.4	56.9	26.8	35.8	25.9	18.8	26.1	.3
9	26.6	1.5	27.7	-------	25	13.7	26.2	3.3	26.1	26.4	26.4	1.3
10	26.8	-------	27.7	-------	26.2	9.9	27.2	.5	25.1	23.2	27.8	6.7
11	27.3	16.8	28.3	-------	26.2	38.9	27.8	40.6	25.3	7.2	26.8	51
12	26.6	46.5	27.9	4.5	26.5	2.5	27.8	-------	24.5	12.5	26	-------
13	26.9	-------	27.3	-------	26	14	27.1	-------	26	6.6	26.3	6.6
14	27.3	26.3	27	61.2	26	32	28.3	16	26.4	2	27	1.3
15	26.7	96.1	25.7	49.6	24.5	136.3	27.6	-------	26.7	.3	26.8	-------
16	26.4	15.1	26	8.6	24.2	182.9	26.8	-------	26.6	.8	26.4	-------
17	26.4	.8	28.3	4	25.9	6.9	26.5	27.5	26.2	-------	24.8	4
18	27.6	9.1	27.6	12.2	27.3	-------	26.8	-------	25.3	.3	25.6	2.1
19	27.1	-------	26.5	21	26.9	-------	27.5	.3	26.4	.5	26	-------
20	27.2	1.8	26.4	5.1	26.5	.5	27.1	-------	26.6	3.8	26.8	-------
21	25.4	52.9	26.4	-------	27	15.3	27.1	-------	26.3	3.8	27.1	-------
22	26.6	1.3	26.4	-------	27.2	-------	27.8	-------	26.8	-------	27.1	-------
23	26.9	-------	27.3	-------	26.7	25.4	28.6	12.7	26.2	2	26.6	-------
24	25.7	3.3	25.3	22.9	26	8.9	27.1	-------	26.1	-------	26.2	-------
25	25.7	4.6	27.3	2	26.2	-------	28	-------	26.4	9.2	26.6	-------
26	26.8	-------	27.6	22.9	26.9	-------	27.2	7.6	25.5	63.6	26.4	6.6
27	28.3	-------	27.8	-------	27.5	-------	27.6	6.4	24.5	20.1	25.1	60.9
28	28.4	4.1	26.2	5.1	27.6	-------	26.8	-------	26.6	-------	26.9	-------
29	26.5	8.1	25.5	2	27	-------	26.6	-------	26.1	-------	26.6	-------
30	27.6	12.8	26.9	-------	27	-------	27.2	.3	26.4	-------	25.6	4.1
31	28.3	4.8	27.6	8.7	27.4	-------	27.9	-------	26.6	-------	26.2	-------

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Z. K. MILLER, Chief.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Horticultural Propagator, I. C. ROOT.
Entomologist, C. R. JONES.
Assistant Horticulturist, H. H. BOYLE.
Assistant Entomologist, D. B. MACKIE.

AGRICULTURAL INSPECTORS.

H. R. REED.
W. A. MACE.
F. P. NICKLES.
E. S. HASKELL.
H. O. JACOBSON.
E. F. SOUTHWICK.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	F. C. KINGMAN, Superintendent.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	GEO. G. WEATHERSBEE, Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	A. M. MEADE and D. F. COYNER, Veterinarians.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	W. A. CURTIS, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

SUPERVISING VETERINARIANS.

Charles G. Thomson. Stanton Youngberg. Charles H. Leavitt.

VETERINARIANS.

J. B. Bell.[1]
W. R. L. Best.
Victor Buencamino.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. L. Davis.
Charles H. Deoker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.
A. H. Julien.
Harry F. Kern.
William A. Kliphardt.
Walter A. Korb.
Herman H. Ladson.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.

[1] On leave.

Photo by C. M. Conner.

Six varieties of Hawaiian cane, first ratoon crop, eleven months old, showing arrows. Alabang stock farm, Alabang, Rizal.

THE PHILIPPINE

Agricultural Review

VOL. VI FEBRUARY, 1913 No. 2

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

THE ANNUAL REPORT NUMBER OF THE PHILIPPINE AGRICULTURAL REVIEW.

In previous years it has been the custom to publish the Annual Report of the Bureau of Agriculture in the January number of the REVIEW following the end of the fiscal year covered by the report. This delayed the appearance of the report for a considerable period, and in 1912 a new policy was inaugurated, that of printing the report as a special number in addition to the twelve regular issues. Furthermore it was decided to have this report appear in English alone, and forward a copy to all subscribers, whether to the English or to the Spanish edition.

Some confusion has arisen on account of the above change, and this office is in receipt of a number of letters from subscribers to the Spanish REVIEW, asking that a Spanish copy of the report be sent to them instead of the English.

The above brief statement is made in order that the subscribers to the Spanish REVIEW may understand that the only copy of the report printed has been forwarded to them.

THE AGRICULTURAL OUTLOOK FOR 1913.

Agriculture never had a brighter outlook in the Far East than it has in the Philippine Islands at the present time. It is true that the effects of the drought of last year are still felt but the present rice crop is far in excess of any grown for a number of years and the cane crop promises well. The farmers are "getting on their feet," as it were. Larger machinery is being used and farming is being carried on under more scientific methods and on a greater scale than ever before.

With the present cane crop at least one large central and perhaps three small ones will begin grinding, something unheard of before in these Islands. Other large mills will begin operations in the near future.

One healthy sign that almost always indicates prosperity is the fact that land is advancing in value and the price of a day's work has almost doubled in the past three or four years.

The people have shown more interest in the cultivation of corn in the last two years than ever before.

The Bureau of Agriculture is trying to keep abreast of this advancement by supplying the farmers with better varieties of rice, corn and sugar cane, and teaching them better methods of handling these crops by operating demonstration farms and sending out lecturers.

BUREAU OF AGRICULTURE CIRCULAR NO. 18—RICE CULTURE.

[Circular No. 18. Manila, September 21, 1912.]

RICE CULTURE.

BY CHAS. M. CONNER, *Chief, Division of Agronomy.*

The cultivation of rice has occupied the attention of the inhabitants of the Philippines for a longer time than any other one crop, and is to-day one of the most important crops because it furnishes nourishment to practically all the people, and is cultivated almost universally. The area under cultivation during 1911 was 1,043,757 hectares, which was nearly equal to the total combined area cultivated in abacá (Manila hemp), corn, coconuts, sugar, and tobacco. The hectarage decreased slightly during 1911 but the average production per hectare was slightly increased, being 19.67 cavans [1] per hectare, as compared with 15.05 cavans for 1909. Some idea may be had of the production by provinces by examining the statistical map appearing in this circular.

The soils of the Philippines seem to be well suited to the growing of rice. Practically any soil in the Islands will grow rice if the necessary water is supplied and held on the plants. Since the retention of water seems to be one of the most essential characteristics, the mechanical nature of the soil should be taken into consideration in selecting a rice field. A fairly fertile soil containing about 50 per cent of clay is best.

The rice plant is aquatic and requires more or less water about its roots at all times for its best development. The rainfall is depended upon to supply most of this water; only about 50,587 hectares are reported as under irrigation. As a rule the rice-growing provinces may be divided into two groups, those that have pronounced wet and dry seasons and those having the rainfall distributed through the year. In the first group may

[1] One cavan equals 75 liters.

be placed the provinces of Bataan, Bulacan, Cavite, Iloilo, Laguna, Nueva Ecija, Pampanga, Pangasinan, Rizal, Tarlac, and La Union. Practically all the other rice-producing provinces fall in the second group. The average rainfall for each group is shown by months in the following chart.

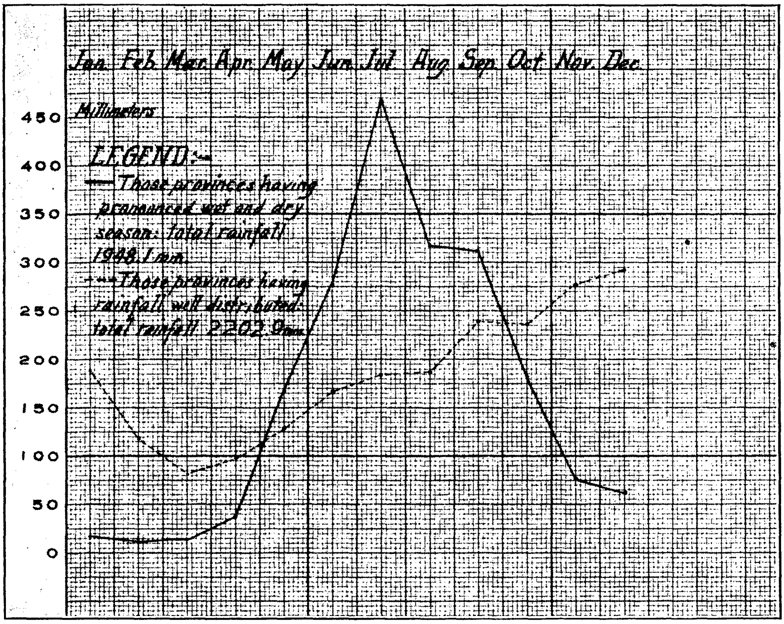


Fig. 1. Rice rainfall chart.

While this chart shows that the rainy season may extend from the first of May to the last of October, the real rainy season usually extends from the middle of June to the last of September.

The average variety of rice requires from one hundred and forty to one hundred and fifty days to mature.

The uncertainty of the time of beginning of the rainy season and the great quantity of water which may fall during a short period of time constitute practically the only drawbacks to the introduction of rice culture by machinery as followed in the United States.

It has been demonstrated that rice reaches its most perfect development, if grown during the rainy season, when the atmosphere is nearly saturated and the temperature is low. The crop grown during the hot dry weather does not yield as much as the former by 25 to 50 per cent.

Whatever method of planting and harvesting is followed, irrigation is almost essential to the best development of the crop. Irrigation water is necessary if two crops are to be grown and will be found valuable if only one crop is produced, as it frequently happens that the rains do not come in time to start the crop off properly and also there are dry periods in the so-called rainy season when a small amount of irrigation water would mean a 50 per cent increase in yield.

It is estimated that it takes 100 to 116 hectare-centimeters of water, well distributed throughout the growing season (say eighty days), to produce a crop of rice. On an average there are about 155 centimeters of rainfall between June 1 and October 30. If it is well distributed this is abundant, but if not, irrigation water must be used to supplement the rainfall.

In case irrigation water taken from streams by gravity is not available it may be supplied from shallow wells or rivers at a cost not to exceed ₱22 per hectare by using a direct-connected centrifugal pump and kerosene engine. An area of at least 50 hectares should be covered to bring the cost down to normal.

One of the first things that the rice farmer should give his attention to is the selection of a suitable variety and he should then keep it pure by careful hand selection. A variety having a clear hard grain, slightly over twice as long as broad, and of uniform size should be chosen. If the rice is grown for commercial purposes a white variety should be selected. A variety should be kept pure so that the grains will all be of the same size and in milling cause little loss from broken grains or grinding down of the large grains on account of the fact that the mill is set for the average-sized grain. A pure strain may be easily started by selecting each head separately the first year and taking care to plant in a clean seedbed and to thresh separately.

A medium early variety should be selected as there appears to be no difference in the yield of varieties requiring one hundred and forty as compared to those requiring one hundred and eighty to two hundred days to mature. Of the two, the variety requiring one hundred and forty days should be preferred because there would be nothing gained by exposing the crop to the ravages of insects and other pests as well as the danger of damage by storm. Again, if two crops are to be grown, a variety requiring longer time could not be used

A variety that is known to yield well should be selected, because it has been shown by variety tests conducted by this Bureau that 12 per cent of the marketable varieties produced less than 1,000 kilos of palay per hectare, 37 per cent produced between 1,000 and 2,000 kilos per hectare, and 51 per cent produced more than this amount.

There is practically no difference in the food value of different varieties. Clear white rice has practically the same food value as red rice. Some varieties have a pronounced flavor, which makes them more popular than others. This flavor is most noticeable just after harvest and is most common among upland varieties.

Nonbearded varieties should be grown in preference to bearded varieties as they cost less to harvest and thresh and give just as heavy a yield, other things being equal.

Varieties having a colored cuticle such as red or black should never be used except for special purposes. Such varieties, when mixed with white varieties, caused them to be classed as "mixed," and as such bring less on the market than unmixed.

Upland varieties may be changed into lowland and lowland may be changed into upland by selection.

Fourth-fifths of the rice grown is transplanted. It requires about 43 kilos, or one cavan, of seed to prepare a seedbed for transplanting 1 hectare.

In planting the seedbed, care should be taken to prepare the land well. Use some well rotted manure, if available. Sow the seed so that the plants will be thirty-five or forty days old (for medium early varieties) at transplanting time. If it is desired to gain time on account of the rains coming late, the seedbed may be prepared in the usual way, and banana leaves spread over the surface of the mud and sunk just enough to cover the seed which should be soaked for forty-eight hours before spreading over the leaves. The leaves prevent the roots from taking hold of the mud and allow the young plants to be separated easily. Plants may be taken from the seedbed by simply rolling up the banana leaves. Plants grown in this way may be transplanted at fifteen to eighteen days old.

Thorough preparation of the field before transplanting will pay well for labor expended. Plow twice if possible and harrow thoroughly.

When transplanted, the distance between the plants should be governed more or less by the variety. Those that have a tendency to throw out many shoots may be given more space; medium

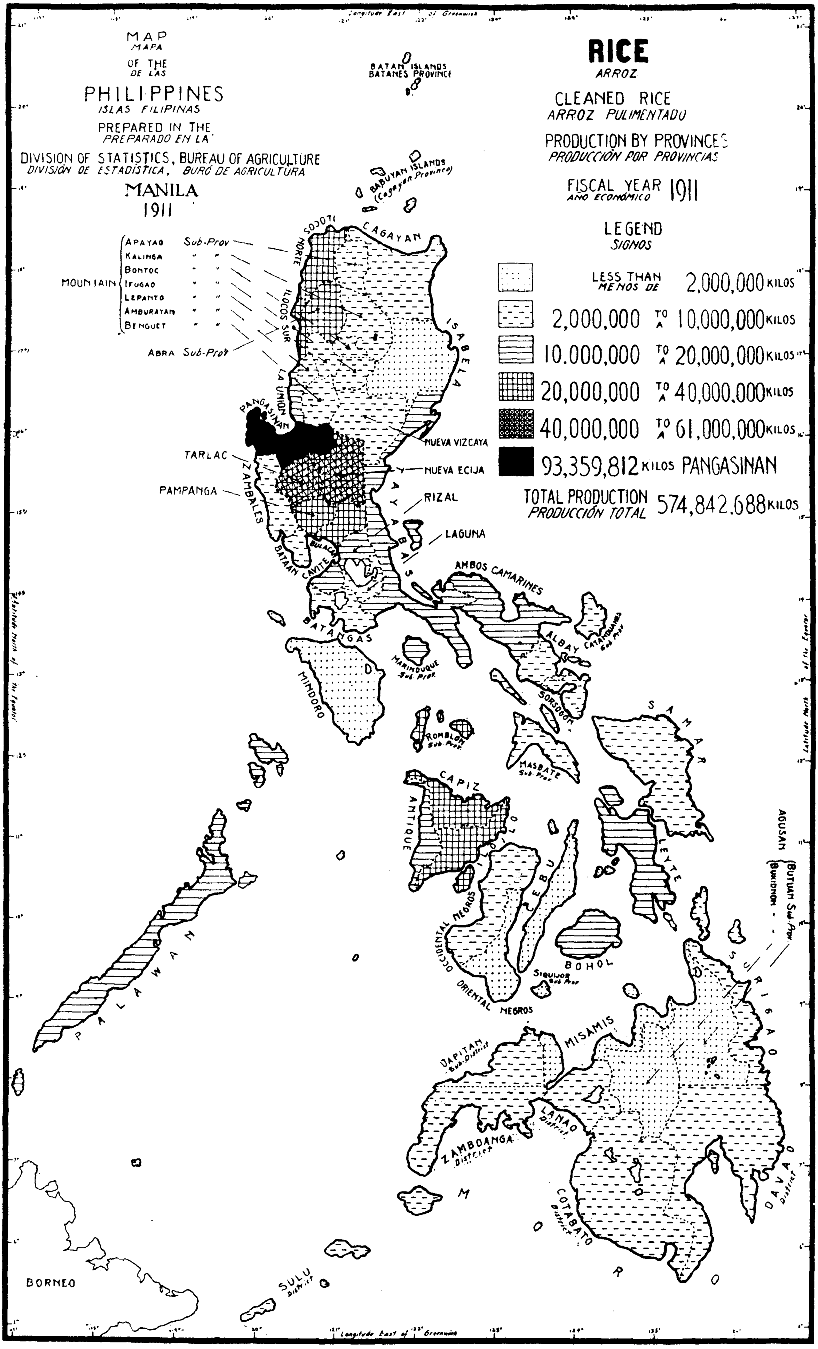


Fig. 2. Rice-production map.

early varieties should be given from 15 to 20 centimeters each way, with three and four plants in a hill. If the young plants are 20 or 30 centimeters high at transplanting time, about one-third of the top should be cut off as there will be less danger of their being blown over by high winds and they will take root sooner. After the young plants have established themselves the water should be turned on and kept moving, as stagnant water is harmful to the plants.

Frequently the second crop, i. e., the crop grown during the dry season, is sown broadcast. If there is sufficient labor to transplant, it is not advisable to follow this system, except in rare cases, as much better yields may be expected from transplanting. It is estimated that only about one-half the yield may be expected from broadcasting as compared with transplanting.

It is possible to grow two crops of rice and one crop of corn in one year by the aid of irrigation water. The corn should be grown during the driest part of the year, as the plowing of the soil in cultivating the corn will allow the air to enter the soil and cause the bacteria to break down the organic matter and otherwise improve it for the next crop. Whenever possible, mungos or cowpeas should be grown in the corn and when the ground is not occupied by growing rice, in order to keep up the supply of nitrogen in the soil. If the straw were left on the land and plowed under instead of being burnt off, it would also add much to the betterment of the soil.

The Bureau of Agriculture has collected and tested 910 varieties of rice native to these Islands. These may be divided into two great classes, upland and lowland. These may again be divided into glutinous and nonglutinous. Of the varieties tested, 452 were lowland and 458 upland. Some were found to do fairly well under both conditions.

The clear white, nonglutinous type is the one known to commerce. The glutinous varieties are used in making "dulces" and for distilling purposes.

The following lowland, white nonbearded, nonglutinous varieties, gave a yield of more than 2,000 kilos, or 46.5 cavans, per hectare as an average of three or more tests and may be recommended for general planting:

No.	Name.	Yield of rough rice palay per hectare.	Province where obtained.	Days to mature.	Average number of grains per head.	Size of grain millimeters.
246	Caoñgedy	2652	Cebu	137	212	5.5×3.0
827	Sipot	2412	Laguna	138	155	6.7×2.5
187	Cainti II	2402	Bohol	138	187	6.5×2.6
635	Mulan-ay	2551	Antique	141	212	6.0×3.0
530	Macan Piña	2659	Tarlac	143	243	6.5×2.6
61	Bengala	2440	Capiz	143	213	6.1×2.6
813	Señora	2571	Laguna	145	191	6.7×2.6
663	Pauni	2310	Tarlac	145	145	6.8×2.3
117	Bugaten	2875	Cebu	149	256	5.5×2.7
868	Tinabas	2373		149	187	7.0×2.5
710	Postoguer	2640		153	181	8.7×3.5
781	Saigon IV	2511	Antique	156	182	7.0×2.1
692	Piniling Daniel	2448	Tarlac	167	221	6.2×2.2
429	Inachupal	2408	Tarlac	168	241	5.9×2.4
447	Inasimang	2515	Tarlac	170	281	5.9×2.7
583	Mancasar	2378	Moro	174	227	6.3×2.5
88	Binatad	2407	Nueva Ecija	175	184	6.1×2.6
527	Macan	2288	Tarlac	178	200	6.1×2.5
27	Bad-as	2371	Occidental Negros	180	152	5.0×2.6
579	Manabun-ac	2831	Antique	183	163	5.6×2.7
598	Manticanon	2561	Tarlac	185	233	6.2×2.7
739	Quinanay	2435		185	187	7.0×2.4
225	Calobang	2623		186	323	6.2×2.4
473	Joquianan	2369	Iloilo	189	273	5.6×2.8
756	Quinatia	2338		189	205	5.2×2.8

If any of the above-mentioned varieties are to be found in the reader's district, it would be well for him to secure a small quantity of seed of each and make a comparative test. At harvest time select by examining each individual head to make sure of color and conformity to type. Carefully preserve these heads until planting time. If irrigation water is available they may be planted as the second crop and the quantity of seed largely increased by the time the next wet season comes around. If the selected seed is kept pure there should be enough seed available to plant the entire crop at the beginning of the next wet season. Selection should be continued in this way each season for three or four seasons, choosing each time the best heads and from plants that are prolific. Even if only ordinary care is exercised in making selections, it should result in a variety that would give a larger yield and a palay of uniform size and quality.

THE WORK OF THE DIVISION OF AGRONOMY.

By C. M. CONNER, *Chief, Division of Agronomy.*

The work of the division of agronomy is confined at present to investigations relative to rice, sugar cane, corn, grass and hay crops, and cover crops.

With rice, efforts are being made to eliminate as much as possible the undesirable kinds and encourage the planting of better varieties. The substitution of a few good productive sorts for the nine hundred and ten varieties now grown throughout the Philippines would mean a gain in millions of pesos to the people of these Islands in increased yield and better quality at no extra outlay of labor or money. It is true that it will be some years before some at least can be persuaded that they should give up their old choice varieties for any new introduction. This has been the experience in other countries and it will be the same here.

Enough work has ben done already to show that 75 per cent of the kinds grown are useless. Something like nine hundred and ten varieties have been tested during the past years but only two hundred remain in the test this season and at least one hundred of these will be dropped at the next planting. All small varieties and those having a colored cuticle have been discarded as they are undesirable as a commercial crop.

Practically all glutinous varieties have also been discarded as their use is restricted and they are not known in the large rice markets.

The elimination of undesirable varieties will be about finished in one more year. The work of building up desirable varieties by selecting the best heads and propagating from these has been started and as fast as desirable varieties can be established, seed will be distributed to the people.

Tests are being made to determine distance to plant, or rather the number of plants to put on one hectare, in order to get the best yield.

Fertilizer tests are being carried on to determine just what fertilizers are profitable to use on rice. All of these tests are being made in different sections so that results, when obtained, will not apply to one locality only.

Work with sugar cane is confined, for the present, to introducing and testing new varieties, ascertaining distance of planting, and fertilizer tests. This work is being carried on at two different points by this division, and by coöperations in various parts of the Islands.

With maize, fertilizer tests and seed selection require most attention. Experiments are being made as to number of crops that can be grown per year profitably. Such matters as distance of planting, number of plants per hill and other like problems are being worked out slowly.

Owing to a desire on the part of the officials of the United States Army to secure data relative to hay production in the Philippine Islands, several grasses have been introduced with the idea of finding one that would be suitable for hay making. Only one, so far, has given any promise and that is being tested out on a rather large scale to see if hay can be produced profitably. During the past year this work has been carried on at two of the Bureau farms and also at San Miguel, Tarlac.

Cover crops are being tried out at the various farms of the Bureau. The object of making these tests is to find a crop that will be suitable for planting, after the rice and corn, to improve the soil. There are many leguminous crops that would be fitted for this purpose if it were not for the fact that they are subject to destruction by insects and plant diseases. If the fertility of the soil is to be maintained, it is necessary to have some such crops as cowpeas, velvet beans or mungos grown on the land after a grain crop such as rice, corn or sugar cane.

POWER PLOWING IN THE PHILIPPINES.

By Z. K. MILLER,
Chief, Division of Machinery and Construction.

The plowing machinery introduced prior to the occupation of the Islands by the Americans in 1898 consisted, so far as known, of one set of cable plows and two or three steam traction engines, all of European make. The cable set was taken to the Island of Negros and tried out, with results so unsatisfactory that no further attempts were made in engine plowing until 1905. It was reported that the land had been plowed to a depth of 30 or 40 centimeters, bringing to the surface a subsoil that contained only a small percentage of plant food. This produced a short crop, and the owners thought the land was ruined. The plows used here were yet in the experimental stage, and were soon broken up and cast aside.

One traction engine was reported as having been tried out in Laguna Province with poor results, principally on account of the narrow traction wheels and generally cumbersome construction; the plow also proved worthless. However, the need of something better than the carabao plow was apparent to the planters in cane-growing districts even at that date, when carabao were both cheap and plentiful. During and following the period of political unrest, the rebellion and insurrection of 1896 to 1902, the majority of work animals disappeared, were killed for food, or died from animal diseases. The fields had been neglected, had become covered with sod, and overgrown with trees. As the farmer again took up the task of cultivating his land with the higher-priced work animals that were not immune to disease, the slow process of bringing the neglected fields into cultivation once more brought up the question of mechanical plowing. This matter was further stimulated by the reports from Hawaii, the United States, and various other countries, of the success that had been attained in those places.

In the central and western part of the United States where the land is almost level, traction engines have come into almost

universal use for plowing and preparing the land, and in many places for planting and harvesting the crops. The soil there is generally of a light sandy nature, friable, and easily worked after the sod has been broken up. At first this work was performed by ordinary steam threshing engines. The manufacturer quickly saw the need of larger machines and broader traction wheels with larger fuel and water tanks. The improvement of all kinds of traction engines, including steam, gasoline, and petroleum, has beeen remarkable in the last ten years.

During the year 1904 the Bureau of Agriculture imported an American-made plowing engine and a gang of plows. This equipment was considered the very best that could be obtained at that time. The engine was a double-cylinder, 35-horsepower, mounted on a locomotive-type boiler. The traction wheels were 80 centimeters wide and 2 meters high. The engine was equipped with two water tanks with a capacity of 300 gallons. Coal or wood was used as fuel. The total weight, when the tanks were full, was 14,000 kilos. The plow was of the share-and-moldboard type, each gang consisting of six 35-centimeter plows cutting a furrow 210 centimeters wide. (Plate III, a).

PLOWING EXPERIMENTS.

The outfit just described was taken to the Government rice farm at Murcia, Tarlac Province, and put to work on old rice land that had not been cultivated for nine years. The soil is sandy, with clay subsoil, and easily worked when moist. The land was irrigated, and the cross dikes leveled off previous to plowing; water was taken directly from the irrigation ditch into the engine tanks; wood was used as fuel. An average of 4 hectares, 12 centimeters deep, was plowed per day of ten hours. While the land was in a moist condition both the engine and plow worked well (except that the latter occasionally became clogged with trash) at an average cost of ₱6 per hectare, not including depreciation. After the land had dried out the plow failed to work as it could not be kept in the ground, the shares and axles wore out very rapidly on account of sand and dust, the rolling coulters were broken off and the plow beams were twisted out of shape, making the plow worthless. Some light disk plows were tried out with about the same results, with the advantage that they would not clog with trash. A test run of thirteen days of eleven hours each, with an ordinary 18-horsepower steam threshing engine, pulling two three-disk plows in moist land, cutting a furrow 152 centimeters wide, and using wood as fuel, gave an average of 4¼ hectares per day at a cost

of ₱4.50 per hectare, not including depreciation. This test was made by an experienced operator on level land averaging about 1 kilometer in length.

Both the plowing and threshing engines gave very good results in moist land. When the land was dry the jolting caused the bolts to loosen, and the dust caused the gears and exposed working parts to wear out rapidly.

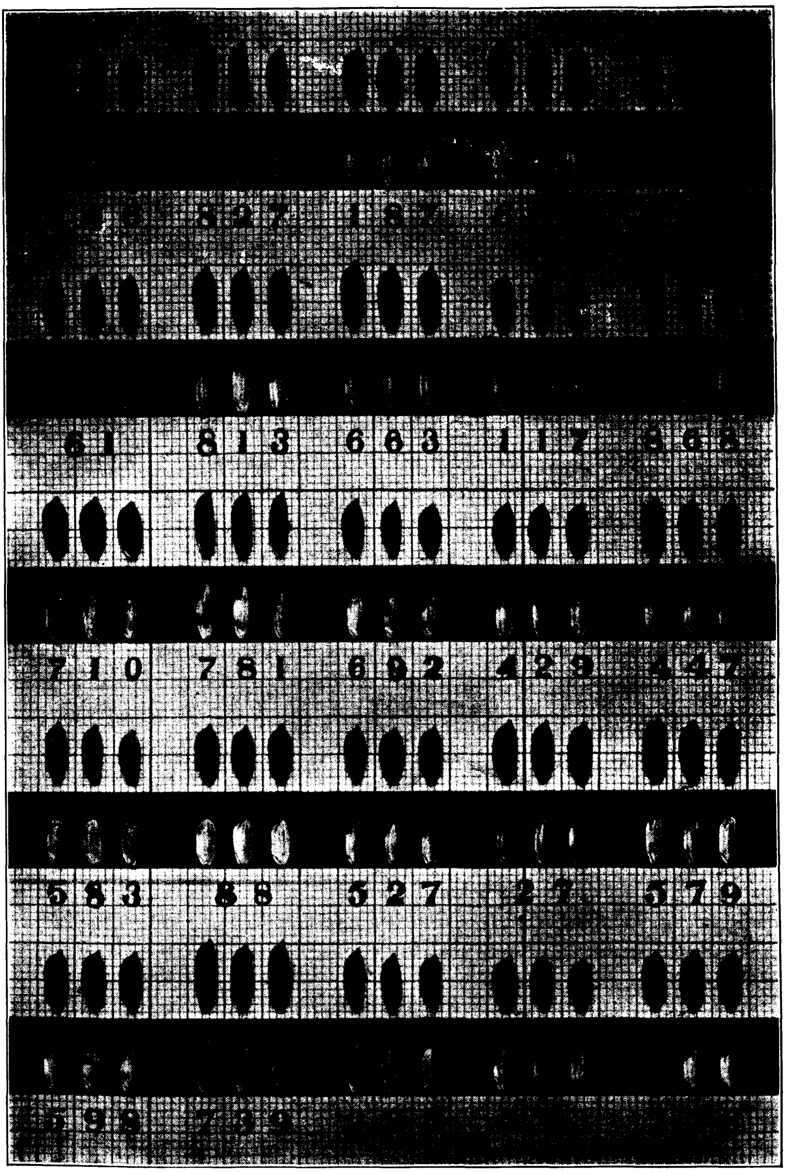
These two engines and equipment were taken to Laguna Province and were tried out on clay soils with the result that the plows were all broken up and rendered useless. More plows were procured (in all six different makes from the United States) and tried out, but all gave the same results. The trouble was that they were all too lightly constructed throughout to stand the hard work required of a plow in this country. During the rainy season the soil becomes packed and when the dry season comes on the land is moist for only a few days, as a rule, before it becomes so dry on the ridges that the plow will not penetrate.

The greater part of the land to be plowed had not been cultivated for twelve years or more, had become overgrown with cogon or talahib sod, and was covered with ant heaps, carabao wallows, trees, rice dikes, cane ridges, etc. On account of the rank growth of vegetation, which was difficult and expensive to clear off, the disk type of plow was selected for this work. These disks are fastened to the beams at an angle that permits them to roll through the land moving the earth to one side and turning it over, and covering up any trash or grass. The disks are set one back of the other in gangs at an angle that will cut all the land. The side pressure is overcome by setting the two furrow wheels on an angle. These keep the plow in position and regulate the depth. As the land becomes hard the side pressure increases until the wheels on the ordinary plow are forced out of the furrows and the plow travels off to one side. When additional weight is put on to keep the wheels in the furrow, the plow frame, axles, beams, and castings, twist out of shape or break.

DESIGNING NEW PLOWS.

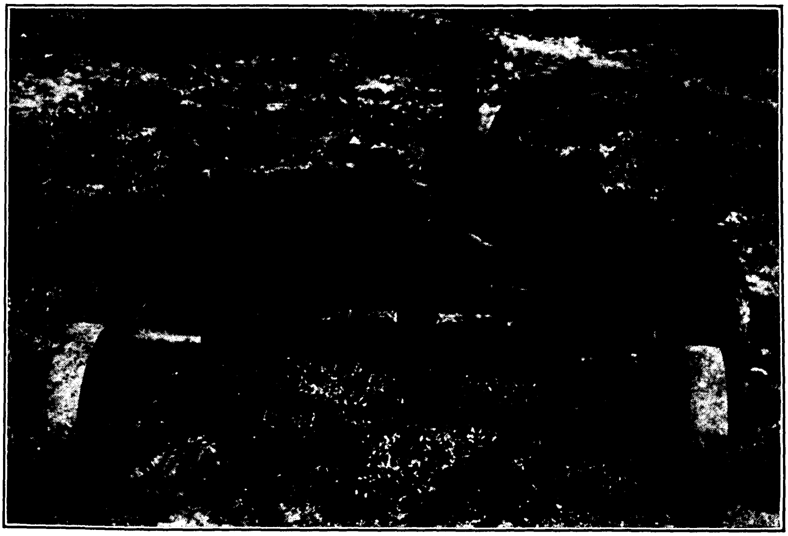
The writer began for the Bureau of Agriculture a series of experiments in plow construction to make a plow that would give good results under these conditions.

A "V"-shaped plow (Plate III, *b*) was constructed having two rows of disks radiating from the point of the "V" forward

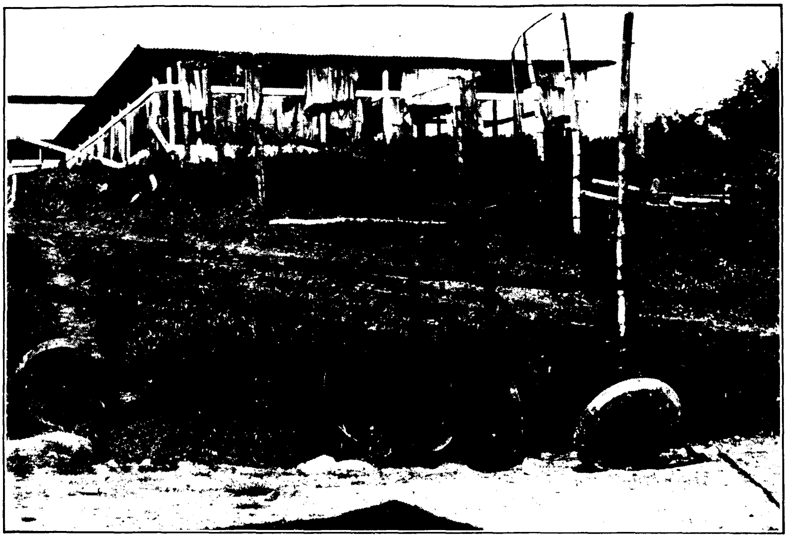


Twenty-five varieties of lowland rice.

(*a*) Kerosene tractor with a six-furrow share gang plow.

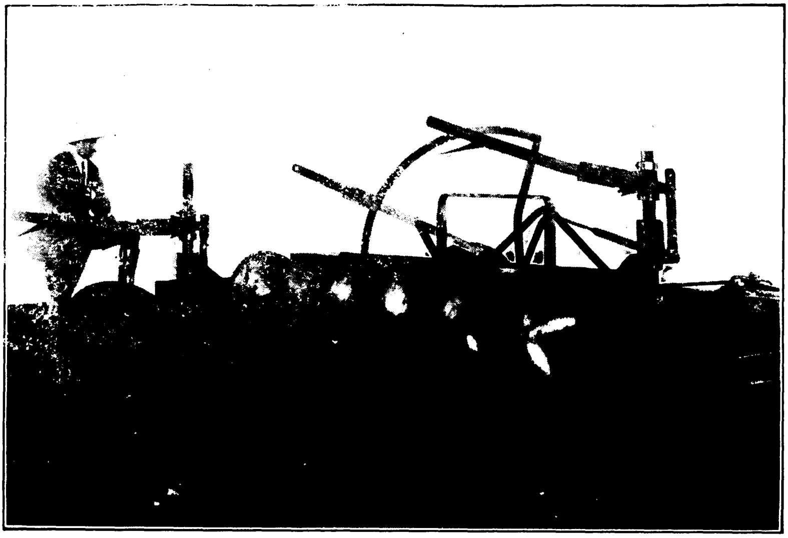


(*b*) V-shaped disk gang plow.

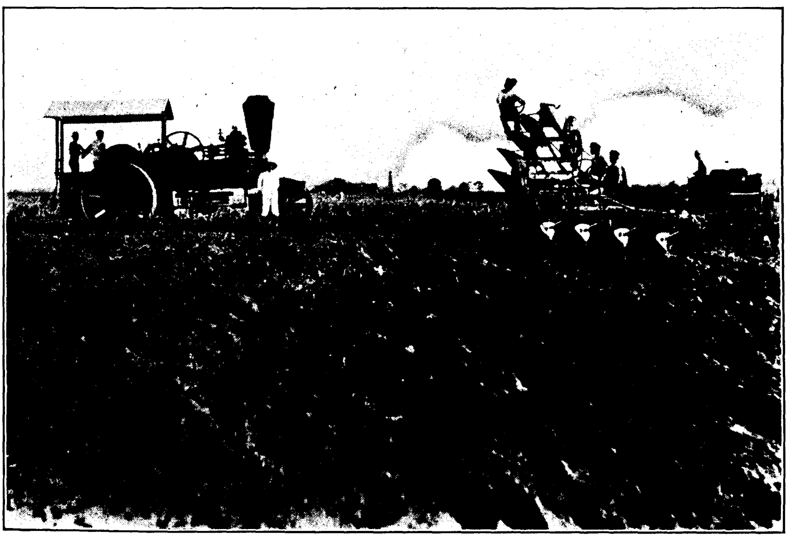


(*a*) Six-disk plow—one hundred per cent heavier than the ordinary plow.

(*b*) Broken disks and castings—effects of contact with stumps, ant heaps, and rice dikes.



(*a*) Heavy six-disk plow—designed to plow any class of soil in the dry season; gives excellent results.



(*b*) Steam cable engine with balance plow.

and at the same angle at the ordinary plow. The disks were placed opposite each other thus offsetting the side pressure as they cut through the land turning the soil outward. The frame was supported on three wheels, one at each point of the "V," two in front and one at the rear. A middle buster, attached to a gooseneck-shaped center beam, plowed out the strip left by the last two disks. The rear wheel was attached to this beam. The beam casting hangers and the castings that the disks were fastened to were made about 100 per cent heavier than for the ordinary plow. This plow would go into the ground when it was very hard and dry, and did excellent work. The principal objectionable feature, however, was that the land was left in ridges, making it quite expensive to level off.

A six-disk plow, built along ordinary lines but of much heavier construction throughout, was designed and made up. (Plate IV, *a*.) The wheels weighed 150 kilos each. The steel beams were 6 centimeters square, the axles 5 centimeters in diameter, and the frame in proportion, well braced. Much better results in plowing were obtained, but even this plow proved to be too light in heavy clay soils during the dry season; when plowing through old rice dikes and paddies, the beams and axles would spring, castings and disks break (Plate IV, *b*), and the wheels were forced out of the furrows, thus throwing the plow out of position.

Another plow (Plate V, *a*), with several improvements and of much heavier construction, was designed along lines similar to those of the one described above. The wheels weigh 280 kilos, and the axles and beams are 7.6 centimeters in diameter. The main frame and bracings are made in proportion. This plow has six disks that turn a total furrow 1.52 meters wide, and 10 to 25 centimeters deep according to the size of the disk used; any sized disk from 61 to 76 centimeters can be used without making any alterations. The total weight is 2,700 kilos. The engine to draw this must weigh 10,000 to 12,000 kilos and have a tractive force of 22 to 30 horsepower in sod breaking, or first plowing in old land, at any season of the year.

Several of these plows have been constructed and are doing satisfactory work. The disks are the weakest part of the plow. The question of making the disks heavier in the center, in order to stand the strain, has been taken up with the manufacturers who have agreed to make them any thickness desired. When this change has been made, this plow will work well in any class of soil during the driest season.

The best results can be obtained by having two plows, one of medium weight and the other heavy. (Plates IV, *a*, and V, *a*.) It will be found that in moist land and in replowing, the lighter plow will give good results and requires less power.

THE STEAM CABLE PLOW.

(Plate V, *b*.)

In recent years several sets of cable plows have been imported and are at work in different parts of the Islands. The larger sets consist of two steam traction engines, equipped with a drum located underneath the boiler. The engines are located on either side of the field, from 400 to 500 meters apart. The cable from one engine is attached to one end of the plow and the cable from the other engine to the other end. As the cable is wound up by one engine, the plow is drawn across the field while the other engine pays out the cable. This plow is made up of two gangs of right and left hand moldboard plows placed on either end of a heavy frame that is balanced in the center and supported on two large wheels. When the plow arrives at one side of the field, instead of reversing, the operator changes to the opposite end and as the engine on the opposite side of the field starts the plow on the return trip the axle is moved forward causing the forward part of the frame to rise out of the ground and the rear part to descend and commence plowing; only a small amount of time is lost in this way. There are several different kinds of implements to prepare and cultivate the fields which may also be drawn by cable. Parallel roads must be constructed at intervals throughout the fields for the engines to run on, and the fields must be cleared of any heavy growth of vegetation to prevent the plows from clogging. The advantages gained in using a cable plow are that rough or very moist land can be plowed where it would be impracticable to operate a traction plow; it is also possible to cultivate the land and to some extent dispense with the use of draft animals ordinarily employed in this work. The land can be plowed to a much greater depth which is desirable for certain crops.

The first cost of the cable plow, which is several times that of a traction outfit, will limit its use on the average plantation as the improved traction outfits will plow as much land as a cable plow and to a depth of 7 to 25 centimeters. With one engineer to operate, traction plows are coming into more general use, and even the largest sugar plantations recognize their value and are commencing to use them in connection with these cable plows.

TRACTION ENGINES.

Traction engines, like plows, need to be of heavier construction, especially in the frame and bracing, than the average engine used in the United States, in order to withstand the shocks incident to climbing over rice dikes, old cane rows overgrown with sod, through carabao wallows, etc. Unless the frame is well braced, it will soon get out of line, shear the bolts and break up. In 1908 the Bureau of Agriculture purchased a double cylinder 30-horsepower kerosene traction motor built expressly for plowing (Plate III, *a*). The main frame was made of 25-centimeter I beams. The cylinders, bearings and braces were bolted to these with heavy bolts. Traveling over the ordinary fields shook the engine up so much that the bolts sheared off. Clips were then placed over the castings and around the I beams clamping them on firmly; the result was that the I beams were cracked in several places.

The carbureters were also defective and complicated. In all, seven valves were used on the gasoline, kerosene and water-feed pipes. When starting the engine, gasoline was used until the cylinders commenced to warm up, then kerosene was turned on and gasoline off. After the cylinder got hot, water was turned on and the amount was gradually increased until the engine stopped pounding. If water was turned on too quickly the engine would be killed. Also when the full load was taken off the valves had to be readjusted, and often when again taking the full load the engine would die. The services of a skilled operator were necessary to keep the machine running.

A kerosene plowing tractor, recently imported, has been in operation for several months in Laguna Province with fairly good results. It promises to be something far superior to any traction motor previously imported. This is only a 15-horsepower machine but the main frame is as heavy as that of the 30-horsepower machine previously described, and wherever possible is riveted together; the cam shaft and automatic governor work in a dust-proof case. The carbureter is automatically controlled by the governor and if the load has been thrown off for an hour or longer no trouble is experienced and no readjustment is necessary when the load is again put on.

COST OF PLOWING.

The cost of plowing with traction engines in the United States and with carabaos in the Philippines is about the same, approximately ₱15 per hectare. The cost of traction plowing in the Philippines depends entirely on the class of soil, fuel, and

season, and varies from ₱3.40 to ₱18 per hectare. The lowest was under very favorable conditions; the highest occurred during a run of twenty-eight days in Laguna Province with a 35-horsepower engine; 64 hectares of land were plowed at the rate of 2.3 hectares per day, at a cost of ₱18 per hectare. Coal, at approximately ₱20 per ton, was used for fuel. The farmer furnished all labor except fireman and engineer and often the steam would be up and the outfit waiting for two or three hours before anyone would appear to man the pumps or bring fuel, and as a rule an ant heap would not be picked down until the engine was against it, and stumps were cut off even with the ground. This resulted in frequent breakage and stops, and increased the cost of plowing.

As a comparison, another planter in the same vicinity procured wood for fuel, cleared off the land in advance, and had the machine properly served. With an 18-horsepower engine, 40 hectares were plowed at the rate of 3 hectares per day at a cost of ₱3.40 per hectare, exclusive of depreciation. The land was prepared by leveling off ant heaps and digging out all tree stumps 25 centimeters below the surface of the ground, and wood was provided in advance, and only a few minutes were required to put on fuel and water at each stop.

The cost of plowing with a cable plow will vary from ₱10 to ₱15 per hectare, according to the condition and class of soil. By making careful preparation in advance, clearing off obstructions, taking out all stumps and roots to a depth of 30 centimeters, leveling off ant heaps and rice dikes, and selecting the best plowing machinery obtainable, there is no valid reason why mechanical plowing can not be made to pay dividends. Especially is this true where land is to be put into cultivation the first time for rice, and on sugar cane and coconut plantations. A conservative estimate of the cost of plowing sodland would be about ₱18 per hectare. This covers depreciation, cost of labor, fuel, repairs, etc., but does not include the cost of preparing the land before plowing. When the quality of the work and time required are taken into consideration, however, the power plow will win out over the carabao where the land is level and in large fields. Experienced men should be consulted before equipment is purchased in order to obtain the best for the class of work required. Care should be exercised and conditions carefully ascertained; for instance, if plenty of wood and water is available, the steam engine would be most economical; or, if fuel is to be brought a long distance, a kerosene motor

would be best. The question of plows is of even greater importance. Some points in operation should never be forgotten. The machinery should be well lubricated and kept in adjustment; sodland and rough places should be gone over slowly; the engine should be started gently and should not be jerked or overloaded; a sharp lookout should be kept for loose bolts; the machinery should be studied and cared for as one would a horse, to give good results.

One of the needs of the present day is a school that will furnish practical instruction and experience in the care and operation of traction machinery, giving young men a thorough course in this work. A certificate upon completing the course at such a school would insure employment in a better position, three times over, than the average clerkship would pay.

A SHORT REVIEW OF THE SUGAR INDUSTRY IN THE PHILIPPINE ISLANDS.

By C. M. CONNER, *Chief, Division of Agronomy.*

ORIGIN.

It is not known just when sugar cane constituted one of the cultivated crops of the people living along the coast of South China or the Malay Peninsula, from whence it was undoubtedly introduced into the Philippine Islands. There is little doubt, however, but that it was first made use of in India, perhaps along the Ganges. As it is not now found in the wild state in any country it is impossible to even guess its original home. There are several grasses growing in the Philippine Islands and in tropical India that are closely related to the sugar cane, but variations in soil, temperature and rainfall cause such wonderful and comparatively rapid changes in all plants in the Tropics that it is impossible to say what a certain plant was like a few thousand years ago. The people who did first make use of it, perhaps found it growing wild in the jungle where it served as food for such animals as wild swine, elephants and other herbivorous animals. That swine fed upon it to a considerable extent would seem very plausible, and in rooting up the mature plants, the younger ones which escaped destruction were cultivated, as it were, and the field was left in good shape for another crop.

FIRST USE.

Undoubtedly the cane was first used in chewing the stalk for the juice. Even at this time one will find sugar cane peeled and cut in small blocks and served at meals in Siam and parts of India. The juice was also extracted by crude methods and used as a fermented drink. Some one finally discovered that by boiling the juice it would become sweeter and would not ferment so rapidly. Geerligs says that fellow-travelers of Alexander the Great mention in their notes a reed growing in India

which produced "honey" without bees. This "honey" was perhaps a thickened sirup made by boiling the juice until it made a thick sugary molasses, called "gur" in India. Such sirup has been used by the natives in India since prehistoric times and is known in Sanskrit as "gud," which indicates a very ancient origin.

In order to make sugar it was only necessary for some one to accidentally boil down some of the juice to the point at which it would crystalize. This occurred about the seventh century in India.

Sugar-cane culture had reached the shores of the Mediterranean early in the Christian Era, and the Egyptians were among the first to make a kind of pure sugar by re-crystalizing. This did not happen, however, until several hundred years after the discovery of sugar.

INTRODUCTION INTO THE PHILIPPINES.

The cultivation of sugar cane and the art of making sugar were undoubtedly introduced into the Philippine Islands by the Chinese. A description of the machinery and early methods used along the coast of China and Formosa reads very much like a description of early methods used in these Islands. Magellan, in 1521, found the sugar industry already established, although on a very small scale.

It is known that sugar making was first carried on in the Provinces of Pampanga and Batangas. The main reason why the industry flourished in these provinces only, in the early days, was that it was not safe to go into other sections with any large amount of property and as it requires a rather expensive equipment to grow and make sugar, the growers did not care to take the risk. However, as conditions improved, the industry began to spread to various other islands.

SUGAR SOILS.

In these Islands there is no "typical" sugar soil. Sugar cane is grown on every kind of soil from light sand to heavy clay, the essential conditions being sufficient natural fertility, good drainage, and a retentive subsoil.

Much of the sugar cane in Pampanga is grown on a light sandy soil of rather low natural fertility. In Laguna and Batangas, the sugar soils are composed of a black, heavy, very retentive clay, except in the neighborhood of Taal volcano, where more or less volcanic ash is mixed with the soil making it rather

light and easy to work as compared with the heavier soils near Lake Laguna. The majority of the soils are of rather high natural fertility. These black, sticky soils around Laguna grow very good cane. The Hawaiian varieties of cane grown at Alabang, Rizal, which is on Lake Laguna, seemed to make as vigorous a growth as did the same varieties at La Carlota, Occidental Negros; no fertilizers were used at either place. The sugar mill at Muntinlupa, mentioned elsewhere, makes sugar from cane grown on this type of soil.

In Occidental Negros most of the sugar soils are of volcanic origin and are of rather high natural fertility. Here and there are found many fertile spots which shade out to poor unproductive soils; there are large areas, however, which compare favorably with any of the sugar soils of the world. The average yield of sugar per hectare for the Province of Occidental Negros, as shown by statistics collected by the Bureau of Agriculture, is 2,295 kilos. This average is lowered by the great number of fields poorly managed and fields of low fertility planted to cane. Walker[1] says "I may state from personal observation that on a well managed plantation—and there are a few such in Negros—the yield per hectare under normal conditions of land actually planted in cane will rarely fall below 60 piculs (3.8 metric tons), and frequently comes nearer 70 piculs (4.4 metric tons); this should hold true in the poorer as well as the richer sections, as the difference in quality of soil is in a measure made up for by the fact that cane grown in the former is as a rule richer in sucrose and is replanted every year on fresh soil, whereas in the latter it is allowed to ratoon until the yield becomes greatly diminished."

COMMERCIAL FERTILIZERS.

Commercial fertilizers are not used to any extent on sugar cane as yet in these Islands, but as more large mills are established and more intelligent methods of culture are put into practice, commercial fertilizers will find their proper place in cane culture. In most of the older cane-growing sections some sort of rotation is followed. In Pampanga and Tarlac other crops such as rice and corn are planted on the land after the cane crop. In Negros it is the custom to allow the fields to lie idle for one year after the last ratoon crop is taken off and pasture the work stock on this land during the season. Both of these methods have their faults. While in the first they

[1] The Sugar Industry in the Island of Negros, page 81.

secure some returns from the lands, such returns are not as great as they would have been had the land been in cane; neither was the soil improved for the next crop of cane. In Negros, nothing is gained in the way of a crop except pasture for the work stock, but the land is slightly improved on account of the increase in humus or organic matter left in the soil by the crop of grass. It would be infinitely better if the fields were planted in cowpeas or velvet beans and the crop either harvested for hay or pastured off with cattle. In either case nitrogen should be added to the soil to produce two or three good crops of sugar cane.

In making use of commercial fertilizers, it will be necessary to make a study of the soil. Different haciendas may require fertilizers of different compositions and much experimenting will be necessary before a formula is decided upon for any one locality.

Fertilizers do not improve the quality of sugar, as many people believe, but on the contrary tend to produce a juice having more impurities than that from cane grown on poor soil. This fact, however, need not discourage the use of fertilizers as these impurities are easily removed by the modern mill. It should be borne in mind, however, that unless there is a uniform supply of water for the crop, either by rainfall or irrigation, much of the expected increase from the use of fertilizers will be lost.

VARIETIES.

New varieties of sugar cane are not easily produced, hence the number of varieties found in these Islands, prior to the organization of the Bureau of Agriculture, was very limited.

New varieties are produced in two ways, first by growing young seedlings, which by the way is very difficult, and by bud-sports from some established variety. Many new varieties have been tested out during the last twenty years but only a few have met the requirements of the planters.

Walker [1] says that "The native cane ordinarily grown in Negros is, in respect to the richness and purity of its juice, equal to that of almost any other sugar-producing country in the world, and, having in addition a comparatively low fiber content, could hardly be improved upon in its adaptability to a thorough and economical extraction by milling." Some new varieties introduced from Hawaii, in 1910, were grown at Alabang, Rizal Province, and La Carlota, Occidental Negros. A test

[1] The Sugar Industry in the Island of Negros, page 81.

was made of these by the Bureau of Science and the results are given below together with the variety mentioned by Walker (referred to above) which is shown in the last line, second section of the table.

Analysis of varieties of sugar cane.

Names of varieties.	Juice.	Polarization.	Brix.	Purity of coefficient.	Names of varieties.	Juice.	Polarization.	Brix.	Purity of coefficient.
	Per ct.	*Per ct.*				*Per ct.*	*Per ct.*		
H-16	75.8	14.3	16.3	87.8	H-227	78.3	14.1	15.9	88.8
H-20	90.3	18.3	19.3	94.9	H-309	93.2	14.9	17.1	87.6
H-27	77.3	17.0	17.9	95.0	Native cane	78.8	19.9	20.7	96.5
H-69	81.8	12.9	15.0	86.0	Negros cane	89.9	18.4	20.3	90.3

Hawaiian varieties of sugar cane grown at Alabang.
Harvested December 20, 1911.

The six Hawaiian varieties mentioned above were planted at Alabang in December, 1910. On December 10, 1911, another field was planted to these same varieties. On November 11, 1912, both these fields were in full arrow. There seems to be something in the climate which makes these varieties mature much earlier than they do in Hawaii. (See Plate I.)

The larger growing varieties, common to Hawaii and other cane-growing countries, have not met with popular favor among the small planters, first for the reason that the stalks were too big for small mills to handle and second because the larger varieties would not respond properly under the native methods of handling. The native cane is planted in rows varying from one-half meter to 1 meter apart, depending upon the locality. Cane so planted soon covers the ground and checks the growth of weeds and grass but does not produce the greatest amount of sugar per hectare. It is true that the smaller native varieties may be planted closer than the larger foreign varieties but the general tendency heretofore has been to plant too close. Some of the more progressive farmers in Laguna and Pampanga are planting the native cane in rows 1 meter to $1\frac{1}{4}$ meters apart; for the larger foreign varieties, the distance is increased 50 per cent.

On the San José Estate at Mangarin, Mindoro, where 5,000 hectares of new land are being planted to cane, the native varieties are planted in rows $1\frac{1}{4}$ to $1\frac{3}{4}$ meters apart and the tendency has been to increase rather than to decrease the distance.

It should be understood that these distances are possible only where the cane is given the best possible culture and attention.

The division of agronomy of the Bureau of Agriculture has the following varieties of sugar cane under observation:

Common Negros purple.
Inalmon, Negros dark purple.
Yellow Caledonia.
Rose bamboo.
Striped Louisiana.
Lahaina.
H-16.
H-20.
H-27.
H-227.
H-309.

A limited number of stalks of these, for seed purposes, may be had free of charge. Large quantities, when available, will be sold at the rate of ₱10 per ton, parties desiring the cane to pay cost of cutting and of transportation to shipping point.

EXTRACTION OF JUICE.

The juice of sugar cane was first extracted by pounding short pieces of cane in a mortar. A small outlet was left at the bottom and the juice allowed to run out into a jar.

The first mills consisted of two wooden rollers set in an upright position and turned by animal power. This was followed by stone rollers cut out of granite at a very great cost of time and patience. The steel rollers are of rather modern origin.

Naturally a large per cent of the actual sugar was lost on account of faulty methods of extracting the juice and only a low grade of sugar was made owing to the methods followed in boiling. These ancient methods, with only slight improvements, have continued down nearly to this date. A new era, however, is dawning for the sugar industry, as modern mills are being installed and sugar of the highest quality is being produced.

CENTRALS.

At the present time there is one large central in operation. This mill has 11 rollers and is capable of grinding 1,200 tons of cane in twenty-four hours. It is located at Mangarin, Mindoro, and is owned by the Mindoro Company. Two mills of like character will be ready to begin operations in the near future. One, owned by the Calamba Estate near Calamba, Laguna, will be ready to begin operations in 1914, and another,

at San Carlos, Occidental Negros, owned by the San Carlos Milling Company, will be ready to begin operations in 1915.

There are also in operation three smaller mills, with a capacity of 125 tons of cane in twenty-four hours, located in various parts of the Islands. One, owned by Macondray & Company, is at Muntinlupa, Rizal Province; another, owned by the Roxas Estate, is located near Nasugbu, Batangas, and the other, owned by S. Urquijo, is near La Carlota, Occidental Negros.

Several other small mills are in project.

As soon as these mills get well underway and the people see that there is more money in selling the cane to the large mills than there is in manufacturing a low grade of sugar, other mills will go up as fast as money can be found to finance them.

THE PRODUCTION OF GRASS AND HAY.

By C. M. Conner, *Chief, Division of Agronomy.*

The native horses used for riding and driving are fed almost entirely on green grass, known locally as zacate. A variety known as barit (*Leersia hexandra*) is grown almost exclusively for this purpose in and about the city of Manila. This brings the highest price of any zacate sold on the market, and is produced under very intensive methods of farming. In the provinces where the owners are not so exacting as to the kind of grass fed to their horses, many kinds of green stuff are used. One of the most common is known as luyaluya (*Panicum repens*), and is found in abandoned rice paddies. Another that is highly prized, but obtainable only at the end of the rainy season, is manimanian (*Alsicarpus*). The surprising thing is that, although there is a great demand for grass for horse feed throughout the Islands, there is no attempt to grow any except in the neighborhood of a few of the larger cities.

As long as the rains continue there is no difficulty in securing plenty of green fodder, but as soon as the dry season sets in the grass becomes short, and the stock suffers for want of feed. During the last dry season there was such a shortage in some of the provinces that many animals died from starvation. This might have been prevented had the farmers followed the practice of growing their forage instead of allowing the work animals to seek a living in the cogon fields and jungle near the farm. The Bureau of Agriculture introduced Guinea grass hoping that it would partially solve the problem of furnishing a supply of zacate for the work stock, but most farmers seemed to think that because it was *grass* it needed no attention. If neglected, this grass soon dies out, but, if cared for, it will yield as much as 60 or 70 tons of green feed per hectare during the year.

Pará grass (*Panicum barbinode*) is well adapted to moist ground and will give large quantities of hay or green feed during the dry season.

One great objection to both of the above grasses is that they must be propagated by setting out the young shoots. A stand can not be secured by sowing the seed.

The cultivation of barit for the Manila market may be worth some mention, as the area devoted to it is in the neighborhood of 500 hectares.

This grass is grown under very intensive methods when considered from the standpoint of ordinary grass production.

As frequent and constant irrigation is necessary to carry on this method of grass culture successfully, practically all of the fields near Manila are below the level of high tide and are irrigated from the river or canals at high tide and are allowed to dry during low tide. In order to bring the land to this level as much as one-half meter of soil has been removed from the surface of some of the fields. The fields are surrounded by dikes like rice paddies. In preparing for the planting, the ground is plowed two or three times, a short period being allowed for the grass and weeds to decay between each plowing. It is then harrowed three or four times with the "suyod." At all times the ground is either saturated or covered with water. After the first or second harrowing the ground is left covered with about 10 centimeters of water for several days. The surface is covered with water at the last harrowing so that the soil may be easily reduced to the consistency of soft batter, as by this method all weeds are killed and the paddy is left level. This leveling is necessary as the fields are kept covered with irrigation water practically all the time except during the period that the grass is being cut and taken off. When the field is ready, the grass for transplanting is cut from a field of barit that has been allowed to stand until it throws out seed heads. It is then tied in bundles and taken to the field to be planted. Beginning at one side the bundles are opened and spread on the soft mud very thickly, the base of the stems being pressed down into the mud. The next bundle is then spread on, slightly overlapping the first, so that when finished the field looks as though it had been thatched. (Plate VII, *a*.) Cut and laid in the mud in this way it sends out roots at the joints and begins to grow. It requires the grass from about 1 hectare to transplant 1 hectare of ground. Ten women and eight men are needed to set 1 hectare in one day. Great care is exercised to keep the fields free from foreign grasses and weeds, which are picked out by hand. The missing spots are filled in but in case the stand has been badly injured the field is plowed

up and replanted. The paddies are kept covered with water for a few days until the plants take root, the water being kept moving as in rice culture, after which it is taken off for a time to allow the field to dry.

This is one case where commercial fertilizers of very high grade are used extensively, from 600 to 1,000 kilos being used per hectare. As much as 10 per cent of nitrogen is used in some of these formulæ. The fertilizer is put on just after cutting but is not harrowed in, hence only easily soluble materials are used. Sometimes tobacco dust is used alone as a top dressing.

The grass is cut in eight or ten weeks after transplanting and every six to seven weeks thereafter—depending upon the amount of fertilizer applied—before it reaches the heading stage. A sharp knife very much in the shape of an ordinary grass hook is used for this purpose. The grass is tied in bundles about 6 centimeters thick and these are put up in large bundles—about as much as two men can carry. (Plate VII, *b*.)

The annual yield will vary with the amount of moisture present, the average being about 50 or 60 tons per hectare.

This grass is retailed at the rate of two bundles for one centavo by small vendors who have stands in various parts of the city, and who, in many cases, are only the agents of the owners of the fields. The price of the bundle does not change but the size has been reduced about one half in the last four or five years. The bundles are uniform in size and as it is necessary to keep the grass wet, and thus fresh, it would hardly be practicable to sell it by weight.

Large quantities of grass of various kinds are shipped from comparatively long distances into Manila. From the lake region comes a coarse heavy grass which grows in the shallow waters along the lake shore, used largely for feeding cattle and carabaos. This is cut and loaded on cascos and floated down the river, making transportation very cheap. Various kinds of zacate for horse feed are shipped to Manila by boat from as far away as Santa Cruz, Laguna.

Each kind of grass goes into well defined channels of trade. Certain dealers handle only one kind exclusively.

HAY.

Hay is used in these Islands for feeding American and Australian driving horses. The native horses are fed almost exclusively on green grass. The above statement, however, does

not take into consideration the horses belonging to the United States Army which are fed on imported feed, except for a small amount of green fodder purchased locally. Up to within recent years no attempts have been made to cure any of the native grasses for making hay, although during the last two or three years several parties have been cutting luyaluya and curing it and selling it on the market. Such hay when properly cured has sold readily in Manila at ₱60 per metric ton.

The Bureau of Agriculture has made several tests of Guinea-grass (*Panicum maximum*) and Rhodes-grass (*Chloris gayana*) hay. Guinea-grass is rather difficult to cure and is not adapted to sowing broadcast hence can not be cut with a mower. The hay when properly cured is relished by horses.

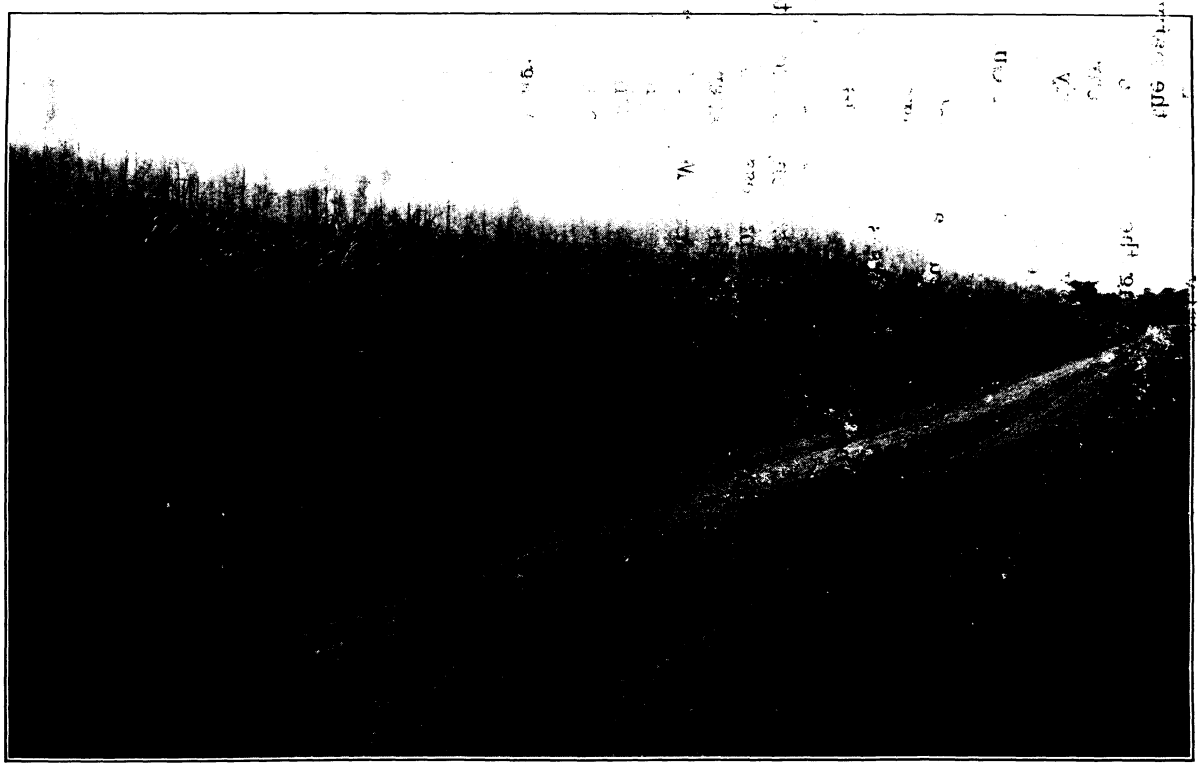
Rhodes grass seems to be well adapted to hay making. To get the best results it should be grown under irrigation in a section where there is a pronounced dry season, in order to cure the hay. If it gets wet during the process of curing it will become discolored and lose part of its flavor. Experiments carried on by the division of agronomy at San Miguel, Tarlac, on new soil, demonstrated that under favorable conditions two and one half tons of hay could be secured at one cutting. At Alabang, on rather stiff clay, as an average of two cuttings, the yield was only about two metric tons per hectare. Under ordinary conditions the grass grows up ready to cut again in from six to eight weeks. Two cuttings of hay, ordinarily, and some years as many as three, can be saved. If the average yield were only two tons per hectare, three cuttings would give us 6 tons worth ₱60 per ton, or ₱360 per hectare, at a comparatively small cost.

Hay made from Rhodes grass compares favorably with timothy. However, when exposed to the air for any length of time it bleaches out. This is also true of Alfalfa and other imported hays.

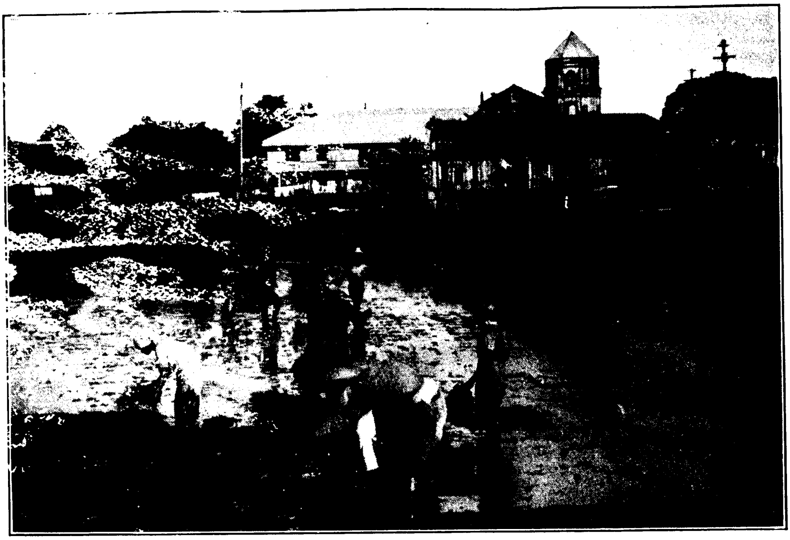
Cured corn-blade fodder makes a very good substitute for hay and some demonstration work has been done to teach the people how to prepare it, although a market is yet to be found. The United States Army has arranged to take a small quantity.

A market for a limited quantity may be found in Manila, Iloilo and Cebu as soon as the people who keep horses learn that the same amount of feed in the form of corn-blade fodder may be purchased at one-half the cost of imported feed.

Hay making is an unknown industry among the farmers of these Islands mainly for the reason that there was little or no

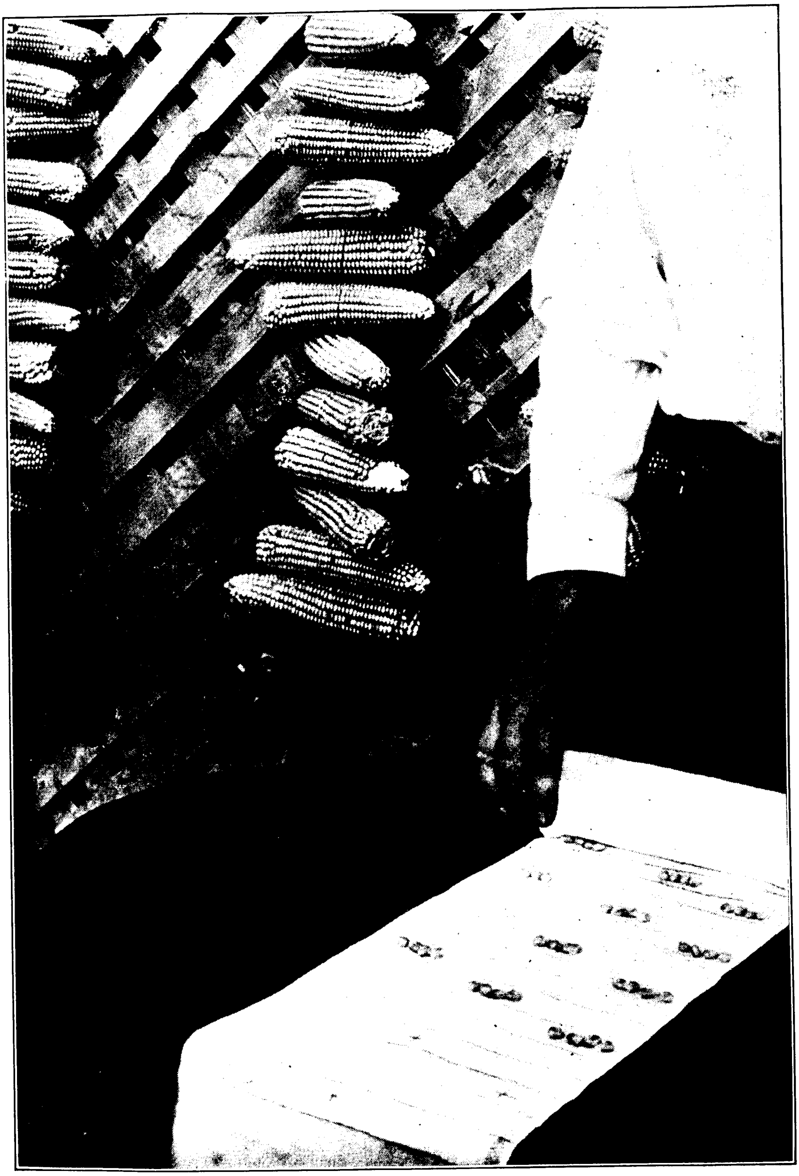


Sugar cane in arrow at eleven months, Alabang stock farm.

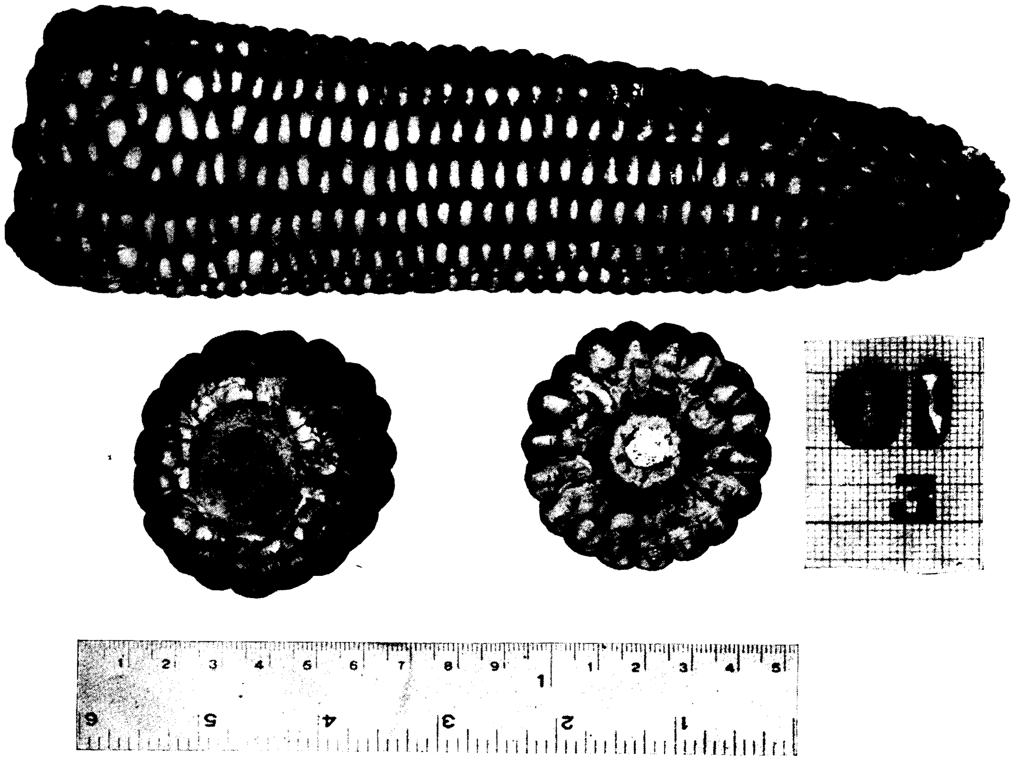


(*a*) Transplanting land to zacate (barit).

(*b*) Cutting zacate for market.



Method of making "rag-doll" test of seed corn.



"Moro"—a new variety of corn.

demand for hay up to a few years ago. These same conditions were found twenty years ago in the Southern States. Now nearly every farm in the Southern States is equipped with hay-making tools, and practically all of the hay used locally is produced there and not shipped down from the north.

There is no reason why good hay can not be successfully made in the Philippine Islands. All it needs to become one of the established industries is that a few pioneers blaze the way.

DATA CONCERNING VARIETIES OF RICE.

By C. M. CONNER, *Chief, Division of Agronomy.*

In Bulletin No. 22 of this Bureau, only such information was given relative to rice culture as would be interesting to the general public. The following data will be of interest to the student as well as the general farmer.

Some very interesting figures relative to varieties of rice have been obtained by the division of agronomy of the Bureau of Agriculture by grouping the varieties tested under certain heads and charting the results. In recording such results, odd figures were disregarded in order to reduce the number of groups; for example, the yields were grouped in even hundreds, and the figures representing relative size were grouped according to whole number, that is, all fractions being dropped.

The upland and lowland varieties are kept separate. It may be noticed that in some cases the total number of varieties considered is not the same as in others. This is due to the fact that complete data were not available for all varieties and only those that had been tested more than one year were included in the lowland list. However, as these tests were made in duplicate at two separate places and trained men were employed in making the observations and recording the data, the figures should be infinitely more valuable than data collected by untrained observers or made up from estimates furnished by local correspondents.

These data are charted on cross-section paper and appear in the accompanying text figures.

INFLUENCE OF DAYS TO MATURITY ON YIELD PER HECTARE AND FREQUENCY.

(Fig. 3.)

In order to secure some data relative to the influence of *days to maturity* on yield, two hundred and seventy-nine lowland white varieties grown in Indo-China were compared with a like number of lowland white varieties grown in the Phil-

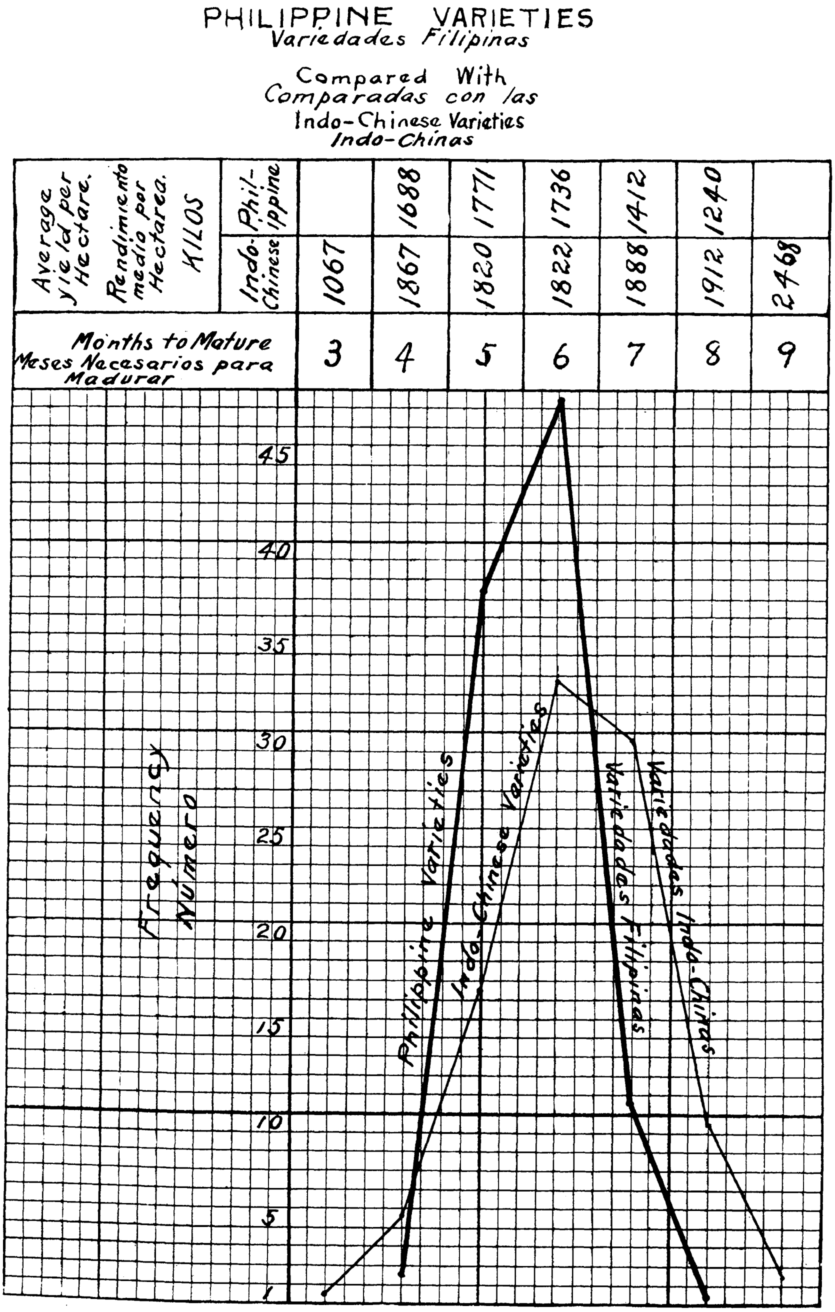

PHILIPPINE VARIETIES
Variedades Filipinas
Compared With
Comparadas con las
Indo-Chinese Varieties
Indo-Chinas
Average yield per Hectare.
Rendimiento medio por Hectarea.
KILOS
Philippine
Indo-Chinese
1688 1771 1736 1412 1240
1067 1867 1820 1822 1888 1912 2468
Months to Mature
Meses Necesarios para Madurar
3 4 5 6 7 8 9
Frequency
Número
45
40
35
30
25
20
15
10
5
1
Philippine Varieties
Indo-Chinese Varieties
Variedades Filipinas
Variedades Indo-Chinas

Fig. 3.

ippine Islands. Each was grouped and charted according to the number of months they required to mature. The average yield of the groups is shown at the top of the chart. The figures at the side marked "frequency" indicate the number of varieties included in each group. It will be noticed that the greatest number of varieties mature in six months from sowing. The average yield per hectare does not increase with the number of months to maturity, in fact, months to maturity bears no relation to the yield. In the case of those grown in Indo-China there seems to be a slight increase in the group maturing in nine months but it will be noted that only two varieties occur in this group. It should also be stated that data available for Indo-China are based upon estimates made by observers while those for the Philippine Islands are actual figures obtained by trained men and, in most cases, are averages of three years for each of the varieties.

If varieties maturing in eight months do not give larger yields than those maturing in five months it is difficult to see why the crop should be subjected to destruction by baguios and insect pests for three months when nothing is to be gained by so doing. Again, if varieties that mature in five months were used it would be possible to grow two crops in one year on the same land.

INFLUENCE OF SIZE OF GRAIN ON FREQUENCY, NUMBER OF GRAINS PER HEAD OR RACEME, AND YIELD.

(Figs. 4 and 5.)

In making a description of the varieties, the length and width of the hulled grains were recorded in millimeters and tenths of millimeters. By multiplying the length by the width and dropping the fraction, we have a whole number which will represent the relative size of the grains. For example, a grain 3.2 millimeters long by 2.3 millimeters wide would be represented by seven, and so on.

Grouping the varieties as highland and lowland under heads represented by these figures, and obtaining frequency, which is shown by the numbers on the right hand side of the chart, we notice that there are only a few of the exceedingly small or exceedingly large grains; also that the smallest grains are found in the upland varieties only. There is another interesting point in connection with this which is not brought out in

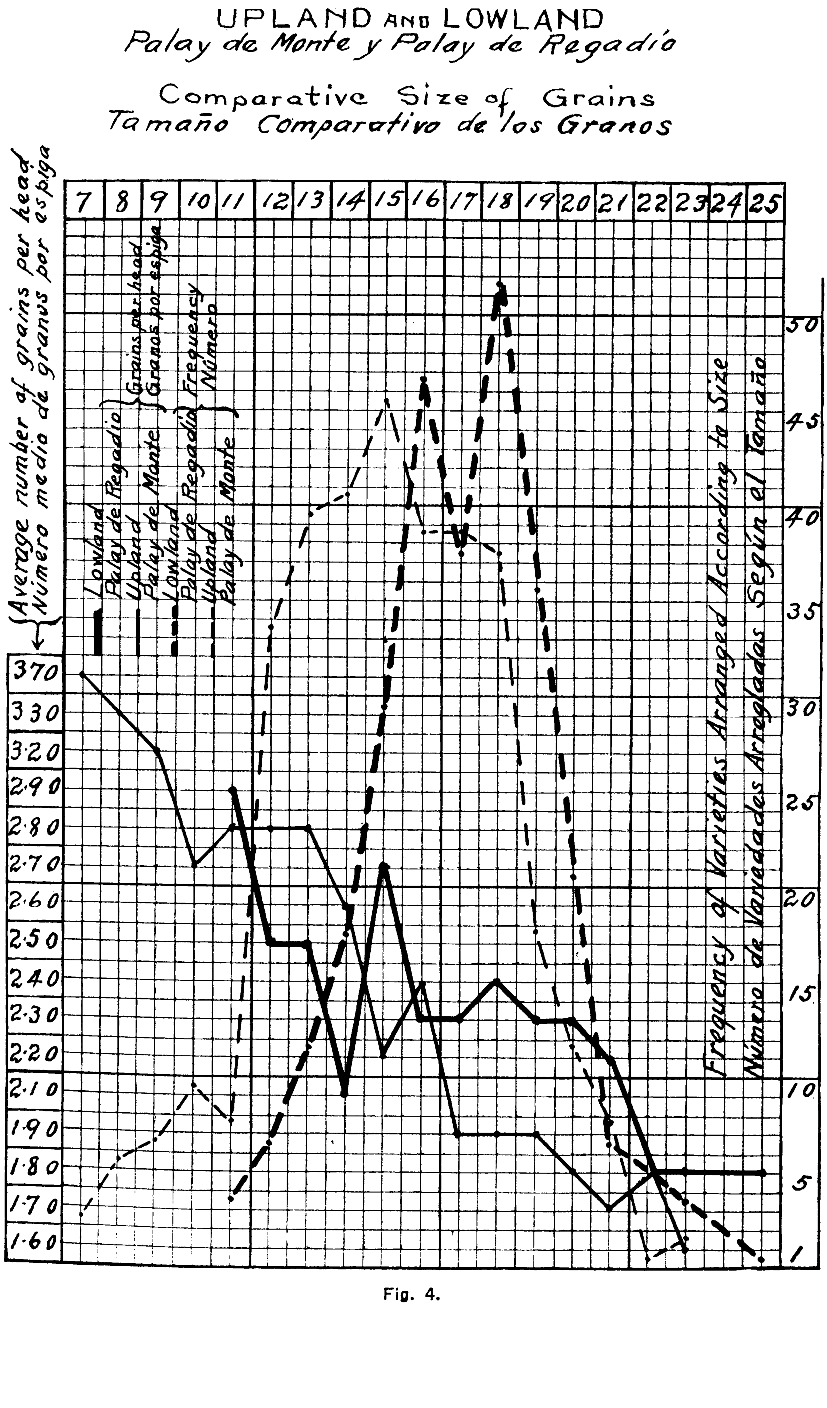

UPLAND AND LOWLAND
Palay de Monte y Palay de Regadío
Comparative Size of Grains
Tamaño Comparativo de los Granos
Average number of grains per head
Número medio de granos por espiga
Lowland Palay de Regadío
Upland Palay de Monte
Grains per head
Granos por espiga
Lowland Palay de Regadío
Upland Palay de Monte
Frequency
Número
Frequency of Varieties Arranged According to Size
Número de Variedades Arregladas Según el Tamaño
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
370 330 320 290 280 270 260 250 240 230 220 210 190 180 170 160
50 45 40 35 30 25 20 15 10 5 1

Fig. 4.

the chart,—namely, that practically all of the upland varieties are nonbearded, while a large percentage of lowland varieties are bearded. When we chart the bearded and nonbearded lowland we find that the smallest grains are found to be among the nonbearded varieties.

The great majority may be said to fall in Groups 13 to 18.

Charting the average number of grains per head or raceme, for each of the groups arranged according to size of the grains,

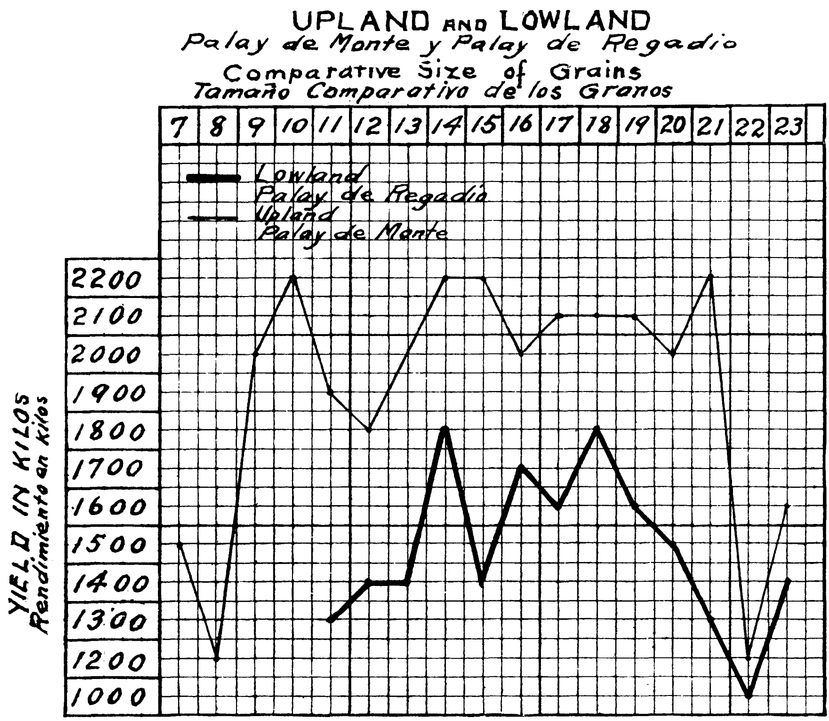


Fig. 5.

we find that the *number* of grains per head is in inverse ratio to the *size* of the grain.

Finding the average yield for each group arranged as above and charting, we notice that the size of the grain has very little influence on the yield except for the very small and the very large grains.

If the above statements prove to be true for future tests it will be possible to furnish the market with any size grains desired without prejudice to the yield.

AVERAGE YIELD AND FREQUENCY.

(Fig. 6.)

Grouping the varieties according to yield for the purpose of obtaining frequency we find that the greatest number of lowland varieties fall within the groups represented by yields of sixteen and seventeen hundred kilos of palay per hectare, while the upland varieties vary with wide limits. If more data were available for upland varieties perhaps the results would be more uniform.

We are frequently asked "What are some of the distinguishing characteristics of upland varieties as compared with lowland?" We have carefully measured the length and width of the leaves of the white nonglutinous nonbearded varieties in both groups and have obtained the following figures:

	Lowland.	Upland.	Increase in upland.	
	Centimeters.	Centimeters.	Centimeters.	Per cent.
Average length of leaf	37.75	53.26	15.51	41
Average width of leaf	1.43	1.72	0.29	20

It was also noticed that the many of the upland varieties had smooth leaves and that the lowland varieties were catchy; that is, if you hold the tip of the leaf in one hand and run the fingers down the blade from tip to base, it feels rough. Making a careful test we find that 1 per cent of the lowland and 40 per cent of the upland have smooth, while the others have rough blades. Practically all the bearded varieties have rough blades. The upland varieties do not stool so freely as the lowland and as a rule have much larger and thicker culms or stalks.

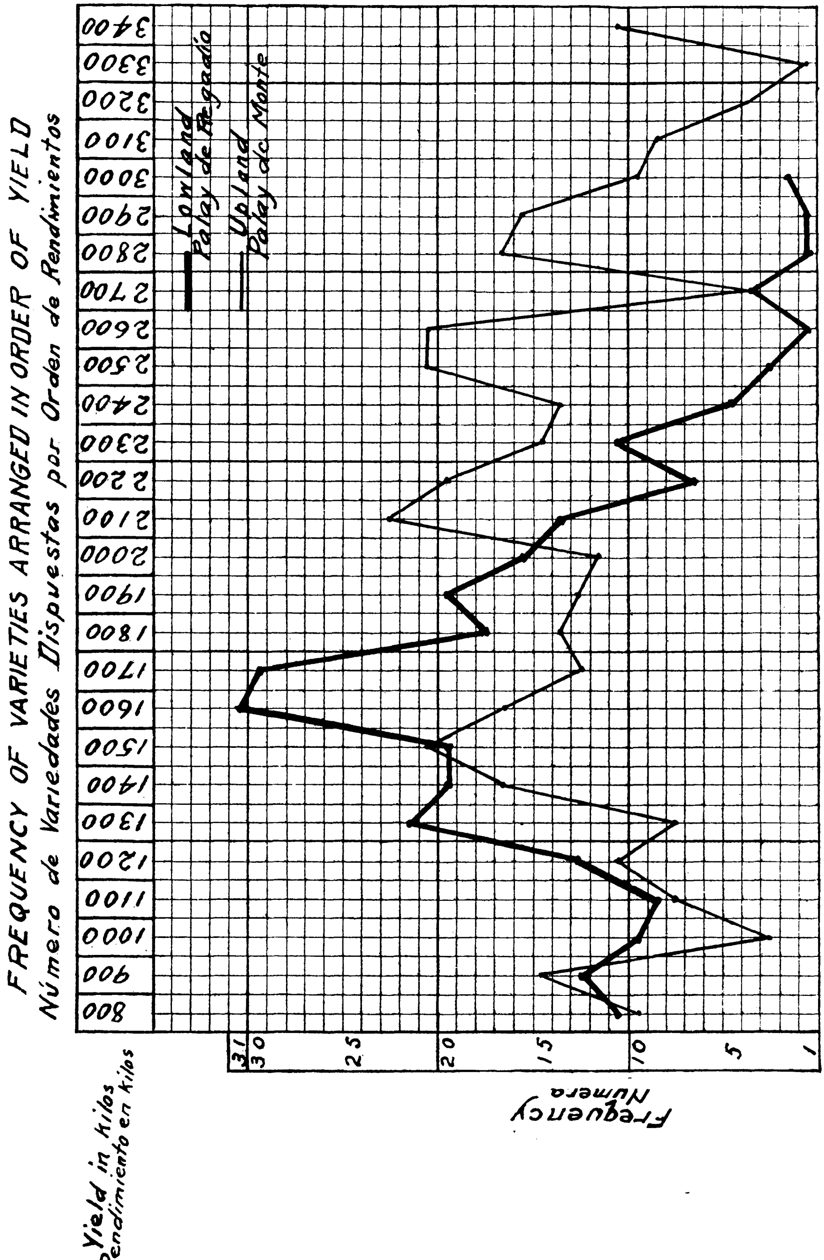

FREQUENCY OF VARIETIES ARRANGED IN ORDER OF YIELD
Número de Variedades Dispuestas por Orden de Rendimientos
Lowland
Palay de Regadío
Upland
Palay de Monte
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
Yield in kilos
Rendimiento en kilos
31
30
25
20
15
10
5
1
Frequency
Numera

Fig. 6.

THE "RAG-DOLL" TEST FOR SEED CORN.

By Henry O. Jacobson, *Agricultural Inspector.*

A method of testing seed corn for vitality which is eminently suited to Philippine conditions is a modified form of the so called "rag-doll" test.

This method was used by the writer fifteen years ago in testing tobacco and small grain seed, and was found more convenient than the plate-and-blotter method commonly used; in fact, a more convenient, economical, speedy and reliable method is yet to be devised.

The materials necessary are a strip of cloth 25 centimeters wide and 3 centimeters in length for each ear to be tested, one round wooden or bamboo stick 30 centimeters long and 2 to 3 centimeters in diameter, and a small quantity of strong twine.

The cloth may be cheese cloth, of double thickness, or canton flannel of single thickness. In fact, any kind of cloth may be used, but a white, fairly loosely woven and inexpensive cloth is preferable.

The first step in the operation is to place the selected seed ears in such order that each ear will have a permanent number during the test. This can be accomplished by tying 15 or 20 ears together on a strong twine, and attaching a label to the first ear of each string, on which is written the permanent number of that ear. Thus when the ears are tied together in units of twenty, the first ear of the first string will be No. 1, the first ear of the second string will be No. 21, and so on. When the first ear is numbered, the number of any other ear on the string can be readily determined. Furthermore, this method positively prevents any disarrangement of the ears, is easily manipulated, and is available at all times and places.

The next step is to prepare the "rag doll" for receiving the kernels of corn.

Spread the strip of cloth smoothly on a table or the floor, smoothing out all wrinkles and place the round stick across one end, giving it a turn so as to start the cloth winding around

the stick. It is a good idea for the novice to rule the strip crosswise into sections of 3 centimeters each, and number each space to correspond with the number of the ear, using an indelible pencil for the purpose.

The string of ears being suspended, it is easy to remove the necessary kernels for the test. For detaching the kernels from the ear the most convenient instrument is a knife having a small, stiff, dull blade. Insert the blade between the rows of kernels and gently pry out the kernels wanted. In this way no injury will be done to the germ, which may occur if the knife blade be thrust into the flat side of the kernel where the germ is less protected.

Do not use kernels from the extreme tip or butt end of the ear since these are generally discarded in order that the seed may be more uniform in size. Remove four or five kernels from each ear, following a spiral course around the ear from one end to the other. In this manner a sample is secured of each equal division of the ear when considered from the standpoint of length or circumference.

Securing the sample kernels from ear No. 1, place them in a row in the No. 1 space on the cloth about 2 centimeters from the left edge of the strip. The kernels from ear No. 2 are placed in the center of the No. 2 space, and the kernels from ear No. 3 in the No. 3 space about 2 centimeters from the right edge of the strip. Now grasp the stick and roll it forward, using care to keep the cloth stretched fairly tight and to see that the kernels remain in their proper position. (Plate VIII.) Proceed in this manner until the roll is completed.

It is neither advisable nor convenient to make strips longer than 3 meters, since this length will accommodate one hundred ears.

When the roll is completed wind a string around it tightly and submerge it in pure fresh water, allowing it to remain therein for forty-eight hours.

At the end of this period the roll is taken out of the water, making no effort to get rid of the surplus water, and suspended in a shady, warm and well ventilated place. It has been found that suspending the roll one-half meter below an iron roof gives excellent results, since the iron roof maintains a degree of heat for a considerable period of time after the sun has gone down. Another good method where ants are to be guarded against is to bury the roll in sand out in the open, just barely covering it over.

In from three to five days the corn will have germinated sufficiently so that it can be easily seen, when the roll is opened, what kernels are dead or of low vitality.

If it is desired to use the cloth again for another test it should be boiled in water or spread out in the bright sunshine for several hours, as either method will destroy any undesirable bacterial or fungus growth. Thus the same cloth may be used repeatedly.

It will be found, when a large number of ears are to be tested, that this method will give better results, with less room and materials, than any other.

A NEW VARIETY OF MAIZE.

By C. M. CONNER, *Chief, Division of Agronomy.*

A new variety of maize which is a cross between Mexican June and a native white maize was exhibited at the last Carnival by the Moro Province. For want of a better name it is called "Moro." The ears average about 19 centimeters long and 5 centimeters thick at the center and have sixteen rows of grains. Two hundred and thirty ears fill a cavan [1] measure while it requires about four hundred and eighty ears of the average Laguna maize to shell one cavan. The majority of the ears are inclined to be cone-shaped but this can be corrected by selection. The buts and tips are well filled out. The grains are white, hard and flinty except for the tips, which have some soft starch. They average 8 millimeters wide by 9 millimeters long. The germ is quite large as compared with the size of the grain.

Plate IX shows a view of the ear two-thirds natural size and in the lower right-hand corner the grain appears natural size.

This variety of maize makes good meal and hominy and should prove quite popular in the demonstration work.

Some preliminary tests have been made and the average yield is found to be much better than the small native varieties.

A large quantity of this maize has been purchased by the Bureau and will be distributed free throughout the Islands.

[1] One cavan is equal to 75 liters.

SALT-WATER RICE.

By C. M. Conner, *Chief, Division of Agronomy.*

On returning from an inspection trip, Mr. H. E. Guyer, superintendent of schools, Tacloban, Leyte, saw a field of rice near the seashore which apparently was covered with sea water. Upon inquiry he was informed that the rice was irrigated with sea water and that this had been done for some years.

Upon request, Mr. Guyer furnished the division of agronomy with 10 kilos of seed of this variety.

The seed palay as received was mixed, a part of it being red. The red and white grains were separated and one set of four tubs was planted with the white and one set with the red.

These tubs were watered as follows:

No. 1.—With fresh water.

No. 2.—With solution of 10 per cent sea water.

No. 3.—With solution of 25 per cent sea water.

No. 4.—With solution of 50 per cent sea water.

As soon as it was evident that the salt water was doing the plants no harm, the tubs receiving 10 per cent were given 75 per cent with no apparent ill effects.

The plants receiving fresh water made a more vigorous growth at first but at harvest time there was practically no difference in the height of the plants in the different tubs. The leaves of those plants growing in the salt water had a darker color than those in the fresh. At harvest time the plants growing in the salt water filled out and the rice seemed to be of good quality.

If this rice can be grown successfully, then thousands of hectares of land which are now overflowed by the tide may be made to produce two crops of palay each year at small cost, as irrigation will not be expensive.

A few of the plants in the tubs receiving the salt water died but it is not certain that the salt water killed them. This test will be repeated on a large scale.

CURRENT NOTES—FEBRUARY.

NOTES BY M. M. SALEEBY, Chief, Fiber Division.

TERMINOLOGY FOR PHILIPPINE FIBER PRODUCTS.

The need for a uniform and correct usage of the terminology of the commercial fiber products of the Philippine Islands has long been felt by the Bureau of Agriculture. The PHILIPPINE AGRICULTURAL REVIEW and the bulletins, circulars, and other publications issued by this Bureau, though primarily intended for the benefit and guidance of the Philippine farmers, are also distributed to commercial and scientific institutions both in the Philippines and other countries. It is therefore essential that the terms used in them to designate the fiber products should be such as would be easily understood by all perusers, whether native or foreign.

Special Order No. 9, series 1912–13, recently issued by the Director of Agriculture, prescribes the terms which should be adhered to in all official correspondence and publications of this Bureau, to the exclusion of others heretofore used indiscriminately. The text of the above order is here reproduced:

Abacá.—The term "abacá" is used in the Philippine Islands to designate both the plant and the fiber. The terms "Manila hemp," "hemp," and "manila," are commercial terms used in the United States and some foreign countries to designate the fiber alone. Of these terms "hemp" and "manila" are both inaccurate and misleading, and should on no occasion be used by this Bureau. The term "Manila hemp" is more generally known throughout the commercial world than the above-mentioned two, and it should be used in preference to them. The term "abacá," being the only accurate and distinctive term which is most generally known in the Philippines, should also be used in connection with the commercial term "Manila hemp," the latter forming a parenthetical expression to the first, thus, "abacá" (Manila hemp). This form should be adhered to on all occasions, excepting in instances in which the term is referred to more than once in any one article or report, when subsequent reference should be made by the use of the term "abacá" alone.

Maguey.—The term "maguey" and "Philippine maguey" are used to designate the fiber produced by the native maguey plant of the Philippine Islands. Either of these two terms can be used. In articles or bulletins, prepared for publication, the first reference to the article should be made

by the use of the term "maguey" (cantala) and subsequent references by the use of the term "maguey" alone. If the product, however, is known to be that of the sisal plant recently introduced from Hawaii, it should be designated by the term "sisal" or "Philippine sisal" in the same way as the term "maguey" (cantala) and "maguey" are used. It will also be proper to use the term "Philippine maguey" (cantala).

Kapok.—The terms "raw cotton" and "tree cotton" are sometimes used to designate this product. These terms are both inaccurate and misleading, and should never be used when referring to kapok. The term "kapok" is the correct term, which alone should be used in all instances. The word should be written with a final "k" instead of "c."

If on any occasion it is deemed advisable to use any local Philippine term in connection with the term "kapok" the former should be used after the latter and inclosed in parenthesis, such as "kapok" (doldol), etc.

The terms to be used for designating the other commercial fiber products and manufactures of the Philippines, such as hats, cloth, etc., are still under discussion between this Bureau and the Bureau of Customs, and they will be published in a similar manner as soon as they are determined. This Bureau earnestly hopes that the press, the commercial community, and the producers in the Philippine Islands will adopt the terms prescribed in the above circular so that uniformity in nomenclature may prevail.

PROPAGATING ABACÁ (MANILA HEMP) FROM SEED.

Until very recently the propagation of abacá from seed was considered extremely difficult, impracticable, and of doubtful results. This belief was not entertained by the planters alone, but also by the several men in charge of the fiber division of this Bureau, including the writer. Recently, however, experimental plantings of abacá from seed made in connection with an extensive series of fiber experiments at the La Carlota experiment station have so far given such unprecedentedly good results as to entitle this method to a more serious consideration than it has heretofore received.

The experiments in question constituted a separate group of plots included in the section set aside for experiments in abacá varieties from the principal abacá districts of the Philippines. The varieties of each district occupied two groups in the section, one for reproduction from seed and the other from rootstocks.

The varieties of southeastern Mindanao were the first to be planted, and the rootstocks were set out in the permanent plots prepared for them at the same time the seed was planted in the nursery. The seed pods, or fruits, were secured from the same varieties as the rootstocks and were transported in the fruit to

the station, where they were thoroughly cleaned and immediately planted in germinating boxes specially prepared for them.

Seeds of the following Mindanao varieties were planted: *Maguindanao, Tangongon, Libuton, Punucan, Baguisanon basag, Baguisanon lawaan, Pulajan, Agutay, Sinabá,* and *Bangulanon,* the first variety and the last one failing to germinate at all, while a very low percentage of germination was obtained from the *Agutay* and the *Maguindanao.* The highest percentage of germination and the quickest growth were exhibited by the *Pulajan, Baguisanon lawaan,* and *Tangongon* varieties, in all of which the growth of the abacá plant is known to reach its maximum extent.

Abacá seed does not retain its vitality for any considerable length of time unless it is carefully preserved, and even then three months have often proved to be too long a period. The best results are obtained from fresh seed which, for this reason, must be transported in the fully developed, but not over-ripe, fruit (seedpod), if it is to be transported from one province to another. This, however, does not apply to its transportation to countries outside the Philippines where more than three weeks are required to reach its destination. For this latter purpose it is best to pack the freshly cleaned seed in a manner similar to that used with other seeds.

The seed should be first planted in germinating boxes. The soil should be very fine and kept moist practically all the time until germination shall have begun. During this entire period the germinating boxes should be placed under complete shade, and after germination, under half shade. Daily watering and constant attention are required until the seedlings have attained the height of about 30 centimeters, when they are ready to be transplanted into the nursery. This stage of growth is usually attained in about three to six months, depending on the quality of seed, the care given the seeds and seedlings, and the variety, but more especially on the last.

The nursery should be very carefully prepared and kept clean from weeds all the time. Before transplanting, the leaves of the seedlings should be all cut back leaving about one-third of each. The seedlings are set out about 20 centimeters apart in the row, and the rows about 40 to 50 centimeters apart. If the rain is not regular and frequent, watering every day is necessary. The seedlings thus planted will continue to grow unchecked, and in four to five months they are ready for the second and last transplanting to the permanent field. If the roots are not muti-

lated in digging up the plants, and if their leaves are again cut back, the seedlings will take root and continue their growth in a surprisingly short time, providing, of course, the soil around their roots is kept loose and moist during the first week.

The Mindanao varieties propagated from seed by the method briefly described above occupy a group of plots adjacent to that planted with the same varieties from rootstocks. Both groups are given the same treatment, and their soil, of course, is identical. The final results, after the varieties in both groups shall have attained maturity, promise to be of great interest, and data and facts, heretofore undetermined, will surely be of value to the growers of abacá all over the Islands. Until these experiments were started, it was a common belief that abacá reproduced from seed requires a year longer to come to maturity than when reproduced from rootstocks or shoots. This belief may already be said to have been disproved for the plants reproduced from rootstocks do not average more than about four months ahead of those from seeds.

FIRST CROP OF MAGUEY (CANTALA) AND SISAL.

The first harvest of leaves from the maguey and sisal plants is always of a much poorer quality than subsequent harvests. This is due to the fact that the first and oldest leaves are always considerably shorter and often more damaged than the later ones, besides being often partly dried up. For these reasons the first crop of fiber is both too short and improperly cleaned, and does by no means represent the quality of the subsequent crops. Besides, such crops almost invariably leave in the minds of buyers a bad impression which may take several crops to overcome.

In order to avoid such occurrences the producers of these fibers, especially those who use or intend to use machinery for cleaning the fiber, should be careful in so marking their first crop as to show that it is not a representative sample of subsequent crops, thereby avoiding future sacrifices on their part.

Attention has recently been called to this important fact by Mr. L. H. Dewey, who cited a recent case of this kind occurring in Hawaii.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

THE VALENCIA ORANGE TRADE.

From our very modest little tangerine traffic of the Province of Batangas we can look up with respect and admiration to the trade in Valencia oranges which now amounts, according to the

Daily Consular and Trade Reports of Washington, D. C., to some 450,000 tons annually. Of this tremendous quantity, all but some 12,000 tons or so are exported by sea to northern Europe, and most of the remainder is exported by rail into France. The Valencia orange district is some 325 kilometers long by 25 to 35 kilometers wide; in this area are grown 90 per cent of all the Spanish oranges.

The Valencia oranges are far superior to the other Spanish varieties and the so-called "Valencia Late" is now one of the best kinds in California and Florida. (A few plants have been introduced into the Philippines but without much success thus far, though it is hoped that the budded plants at the Lamao experiment station will soon make a good showing.) In this famous district the good plantations yield at the rate of ₱4,000 to ₱6,000 per hectare. Needless to say, all the trees are budded stock mostly on "sour lemon," though in the damp, heavy soils the "sour orange" is preferred; this should be a lesson to the Batangas naranjita growers who are risking serious loss by the gum disease in their using only seedling plants. Fertilizers are, of course, used heavily, although the expenses in this line amount to only some ₱200 to ₱300 per hectare per year.

The famous "Seville," or bitter orange, of southern Europe, is now used largely in preparing a concentrated pulp which is shipped in 5-kilo tins to London, there to be used in making the justly famous "Scotch orange marmalade."

AVOCADO COMMERCE.

Florida, Cuba, and Porto Rico have been supplying most of the demand for this excellent fruit in the Eastern States—Mexico to a certain extent supplying the California trade, of course, and a few coming into California from the Gulf ports. Recently, however, the demand for this fruit has been so great that middlemen can afford to risk long-distance shipments from the British island, Trinidad, at the mouth of the Orinoco River, to New York; large shipments are now being made from that island with considerable loss in transit, of course, but with a fair profit to the middleman. The first price is only ₱0.10 per fruit and the wholesale market price in New York at least ₱0.30—the retail being double or more the wholesale price.

As might be expected from the various introductions from all parts of North and South America and the West Indies, a number of very interesting types, from the apple-shaped to the long bottlenecked type, are in evidence.

EAST AFRICAN COCONUTS.

Besides the very heavy planting which is now going on in the state of Quelimane, or, as it is popularly called, Zambezia, in the Portuguese colony of Mozambique, there is considerable activity notable in other East African countries. For instance, Zanzibar, famous in the past as the clove garden of the world, is now becoming more interested in coconuts. On account of faulty cultural methods the clove gardens of that archipelago have for the last six or eight years been deteriorating and although the whole Zanzibar Protectorate, including the large island of Pemba, still produces nearly four-fifths of the clove crop of the world, together with considerable cinnamon and black pepper, the thrifty Hindu agriculturists are crowding out the old-fashioned Swahili native planters.

CHINESE NARCISSUS.

Almost everyone is familiar with the so-called "Chinese Lily," this being one of the very few bulbs which can satisfactorily be flowered in a dish of pebbles and water. These bulbs, which are really nothing but a special variety of Paper White, or Polyanthus, Narcissus, are grown almost entirely in the district of Chang-Chow, near Amoy in South China. They are grown by a special method in the rich alluvial soil to which a special fertilizer is added. The crop is of great importance to European and American florists, but unfortunately this variety of narcissus can not be profitably raised either in Europe or America.

The crop is reported to be unusually good this season, and bulbs which generally bring some ₱18 per thousand in Amoy have been selling for only ₱12 to ₱14 per thousand. It is interesting to note that middlemen absorb most of the profits between the producers' price of ₱0.01 per bulb and the retail florist's price of ₱0.20.

RARE FORMOSAN TREES.

The dendrologist sometimes has the unique pleasure, or perhaps sorrow, of contemplating all the known specimens of certain species of trees at one glance; this occurred some years ago, for instance, on one of the small islands off the coast of Southern California. We now learn of two other cases in northern Formosa; the most striking being the Shimamomi (*Keteleeria davidiana*), there being only one small cluster known to exist in the island; a still more striking case is that of the *Cunninghamia konishi,* of Mount Randai: of this tree it appears there are only five living specimens known.

GOATS.

The humble goat is deplorably unpopular in most of the districts of the Philippines. To be sure it does sometimes require fencing, it does occasionally die from disease, and most of the sorts raised here are of little use for milk production; but there are other goats and other methods.

In Mexico small herds of goats are very common, especially in the Pedregal, or lava-field districts of the Mesa, throughout the interior of the Republic. These herds are frequently neither fenced nor sheltered—save, perhaps, by the overhanging lava masses about which the corrals, or night pens, are built. These goats are used not only as meat animals but as milk, and even cheese, producers. The cheese and milk are frequently combined with sugar in the preparation of various sorts of "dulces." Cattle could hardly exist in the Pedregal country because of the sharp rock edges which would soon wear out the hoofs of any large animal.

In Belgium 425 new Goat Improvement Syndicates are announced with 40,260 members who own about 50,000 goats. Realizing that the average husbandryman does not know much concerning the points of a good goat and cares less for the pedigree, these syndicates are endeavoring to popularize the industry and give practical demonstrations to the farmers. Breeding registers are kept by the secretaries who also collect the nominal service fee (₱0.20) and who arrange for the purchase of the best kids, for breeding purposes, at ₱0.20 to ₱0.30 per head. The syndicates are united into provincial federations.

Such a system unquestionably makes for breed improvement and financial success. The Philippines greatly need the benefits which the Belgium system will bring.

A NEW EARTH NUT.

A new earth nut, or ground bean, has recently been discovered in West Africa. This is related to the peanut and the so-called Bambarra nut of East Africa, Madagascar, and the East Indies. The new plant is known as *Voandzeia poissoni*, or *Kerstingiella geocarpa*. This new cousin of the peanut is of considerable economic importance to the natives from Dahomey to Nigeria, though to the women of the former country it is tabooed. The Bambarra nut (*V. subterranea*) has just been discovered in a wild state. By the way, the writer has seen it growing practically wild in the "bush-veld," or open forest, in the state of

Inhambane, Portuguese East Africa, in which region it is also frequently cultivated by the Kafir tribes, and sometimes may be seen growing side by side with the other earth nut, a variety of the common peanut resembling the "Spanish" type.

THE WORLD'S PRESENT SUGAR CROP.

From the Boston News Bureau we learn that the world's present sugar crop is a record one and that there is a good outlook for a 15 per cent increase for the coming season. The estimate for this crop is 15,880,000 tons, and the chances are that the next crop will run to well over 18 million tons. The Cuban crop just finished will total nearly 2 million tons; this is away ahead of the 1911 crop. The European beet-sugar output is estimated at some 8,600,000 to 9,000,000 tons for this season.

The Philippines produce only about one-seventy-fifth of the total sugar crop.

GARBANZO OR "CHICK PEA."

All over the world there is a renewed interest in the garbanzo, or "chick pea." Europe takes a tremendous amount from India and now the United States is importing large quantities from Mexico. The crop from northwest Mexico is greatly in excess this season over the 1911 crop. Some 22,000 tons have been exported through the port of Nogales during the season just closed while during 1911 there were only some 6,500 tons so exported, or less than a third of the present amount.

In New York the garbanzo is now used as a confectionery material; the seed is roasted and dipped in various sugar preparations just as almonds are coated for the candy trade. The idea is borrowed from the Levant where this richly flavored seed has long been much appreciated.

In certain districts of west central Mexico visited by the writer in 1899 a very high grade of garbanzo is grown for export to Spain, although the bulk of that grain consumed in Mexico is imported from Spain.

NOTES BY C. R. JONES, Entomologist.

A NEW COCONUT PEST.

Promecotheca cumingii Baly.

Attention has been called to a new insect infesting the coconut palms, belonging to the family Chrysomelidæ, subfamily Hispidæ, which contains our most destructive leaf-eating beetles.

The members of this sub-family vary greatly in general structure but may be easily recognized by the V-shaped position in which the antennæ are carried.

The injury caused by this beetle is not restricted to the larval stage alone but the adult also feeds upon leaflets, slitting them longitudinally.

The larva is a true leaf-miner, even the pupa stage being passed within the tissue of the leaf.

The eggs are deposited singly on the under side of the leaflets, and generally on the lower leaves of the young palms, the female having previously eaten a small hole through the tough epidermis so that the young grub can enter the soft parenchyma immediately upon hatching. The egg is cemented into place by a glutinous secretion which soon turns a brownish color. The larvæ are pale green, footless grubs about 9.5 millimeters in length when full grown. In feeding, a more or less irregular oblong chamber is formed, and it recedes to the center of this to pupate.

The injury caused by the larvæ is greater than that caused by the adults; the combined attacks of both give the infested palm an unhealthy or blighted appearance.

As yet the ravages of this beetle are more or less local but it has been found from the Cagayan Valley in Northern Luzon to the Visayas in the south.

The eggs, larvæ and pupæ are highly parasitized, the infestation being over 50 per cent. Without the control exercised by these (hymenopterous) parasites, this leaf-miner would undoubtedly become a rather serious coconut pest; however, should this beetle increase in such numbers as to cause a serious outbreak, its habits are such that its control could probably be easily accomplished by collecting and destroying the infested leaflets.

KEROSENE EMULSION AND LOCTONES.

During the past month in Negros Occidental several experiments were carried on to test the effectiveness of kerosene emulsion on young locusts in cogon and grassy areas. A stock solution diluted to one-half to one-fifth was used, and liberal applications were made using about five times the supposed requisite quantity. The applications were made during the evening when the hoppers were concentrated upon the grass. While numerous loctones were killed the percentage *in no case was over fifty per cent.*

INJURY TO RICE ERRONEOUSLY ATTRIBUTED TO INSECTS.

Up to October 10, 1912, the superintendent of the demonstration station at Iloilo had received numerous reports regarding insect injury to rice in the Provinces of Iloilo and Capiz. From the reports received from Capiz it would seem that the entire crop was being destroyed by insects, so it was deemed advisable to make an investigation of these infested areas.

At Capiz after a conference with the governor the supposedly infested fields were inspected and it was found that the rice was attacked by the horned rice caterpillar (*Melanitis ismene* Cram.), the rice grain bug (*Leptocorisa acuta* Gem.), the rice Caterpillar (*Spodoptera maurita* Boisd.), the rice stemborer (*Schœnobius punctellus* Zell.), and two species of Coccinellidæ. As is always the case, these insects could be found in almost every field but not in sufficient numbers to warrant alarm.

There occurred in many rice fields strips of fallen grain due undoubtedly to the fact that the stem was unable to bear the weight of the grain—this year being an exceptionally favorable year for rice production in these sections—and not to the "stalk-borer" nor to any of the other insects named above, as was supposed. This "lodged" condition was obvious in numerous fields along the railroad from Pototan to Capiz. The fact that the rice stalks were in a compact mass wherever they had fallen, and the decomposing of same caused by the heat, lead to the belief that the injury was caused by insects.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—NOVEMBER.

By the INSULAR COLLECTOR OF CUSTOMS.

(Values in dollars United States currency.)

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Totals.
Rice	Kilos	12,087,325	1,520,360	1,710,656	15,318,341
	Value	531,418	54,393	68,206	654,017
Beef cattle	Numbers	1,013			1,013
	Value	22,186			22,186
Eggs	Dozens	339,652	317	161	340,130
	Value	28,038	30	22	28,890
Sugar	Kilos	277,976	55,840	27,036	360,852
	Value	22,970	5,001	2,034	30,005
Coffee	Kilos	64,175		1,188	65,363
	Value	20,726		430	21,156
Cacao	Kilos	57,297		430	57,727
	Value	18,651		162	18,813
Raw cotton	Kilos				
	Value				

EXPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Totals.
Hemp	Kilos	8,741,331	1,419,328		10,160,659
	Value	1,427,822	262,409		1,690,231
Copra	Kilos	12,509,178	1,964,608	260,992	14,734,778
	Value	1,227,810	191,798	23,150	1,442,758
Sugar	Kilos	2,166,611	1,036,302	5,535,980	8,738,893
	Value	93,737	49,445	227,992	371,174
Cigars	Thousand	9,017			9,017
	Value	160,185			160,185
Cigarettes	Thousand	4,699			4,699
	Value	6,551			6,551
Tobacco	Kilos	1,753,263			1,753,263
	Value	277,992			277,992

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

NOVEMBER, 1912.

[Temperature and rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp. Albay. Temperature.	Hemp. Albay. Rainfall.	Hemp. Tacloban. Temperature.	Hemp. Tacloban. Rainfall.	Sugar, Iloilo. Temperature.	Sugar, Iloilo. Rainfall.	Rice, Tarlac. Temperature.	Rice, Tarlac. Rainfall.	Tobacco. Aparri. Temperature.	Tobacco. Aparri. Rainfall.	Tobacco. San Fernando. Temperature.	Tobacco. San Fernando. Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.3	26.2	26.3	40.4	25.6	105.4	28.2	1.8	26.5	------	27.2	------
2	27.2	15	26.6	6.9	25.7	2	27.6	------	26.6	------	27	
3	27.7	------	26.3	3.6	26.3	------	27.7	1	26.8	------	26.8	.3
4	27.8	------	26.8	1.5	26.3	------	27.3	1.8	27	------	27	------
5	27.4	18.3	26	66.3	25.8	16	27.2	------	25.9	1.5	27.8	------
6	26.9	20.8	26.8	10.1	24.6	80	25.8	1.5	26.2	1.5	25	
7	26.2	6.3	25.3	30.8	26	22.1	25.2	1.5	26.4	4.3	26.3	------
8	26.9	7.8	26.3	4	26.1	14.7	25.6	2	25.8	11	25.8	------
9	27	34.1	25.4	38.2	26.4	1	27.2	------	25.8	3.1	25.8	------
10	26.7	3.6	26.1	6.6	26.5	------	26.6	------	25	15.8	25.8	------
11	27.4	4.1	27	.8	26.9	------	26.6	------	25.8	------	26.3	------
12	26.9	.9	26.3	.5	26.6	4.5	26.1	------	25.4	------	26.2	------
13	25.9	24.6	27	------	27.2	------	27.2	.5	25.5	------	26.2	------
14	26.4	------	26.9	------	26.8	------	27.1	34.3	25.9	14.8	26.2	------
15	26.7	------	27.5	------	26.9	------	26.6	------	24.3	16.2	25.8	.3
16	27	14.7	27.4	------	27.4	------	27	------	23.5	18.3	26.4	------
17	27.8	------	27.5	------	27.1	------	27.3	------	23.9	14.3	26.4	------
18	27.3	------	27.1	3	27	------	26.9	------	24.3	.5	25.8	------
19	27	------	27	------	26.4	------	27.3	------	25.3	107.9	26.2	------
20	27.2	------	27.3	------	26.6	------	26.4	------	24	4.4	26	------
21	24.7	10.7	27.1	------	26.9	------	27.4	1.8	24.2	------	25.6	------
22	26.5	------	26.3	22.6	25.6	24.4	26.2	------	24.4	4.3	25.5	------
23	26.8	2.3	27	------	26.2	------	27.3	------	24.1	9.6	25	------
24	25.8	31.7	25.6	75.8	26.2	60.7	26.6	------	24.1	------	24.4	------
25	26.1	.5	25.9	2.5	------	43.7	25	.8	23.7	2.6	25.6	------
26	26.6	------	27.5	------	25.4	------	25.9	------	25.9	------	27.6	------
27	26.8	1.3	26.4	13.5	26	10.7	26.2	------	25.2	------	26	------
28	27	100.9	27.5	9.4	26	17.2	26.3	.5	25.1	8.9	26	------
29	25.8	3.5	25.9	------	25.4	7.6	26.6	19.8	25.6	38.8	25.3	.5
30	25.5	5.1	26.7	1.3	26.6	------	25.1	12.4	22.6	87	25.2	.3

115968——5

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Vacant.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Entomologist, C. R. JONES.
Assistant Horticulturist, H. H. BOYLE.
Assistant Entomologist, D. B. MACKIE.
Horticultural Propagator, I. C. ROOT.

AGRICULTURAL INSPECTORS.

H. R. REED.
W. A. MACE.
F. P. NICKLES.
E. S. HASKELL.
H. O. JACOBSON.
E. F. SOUTHWICK.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	F. C. KINGMAN, Superintendent.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	GEO. G. WEATHERSBEE, Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	A. M. MEADE, Veterinarian.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	W. A. CURTIS, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

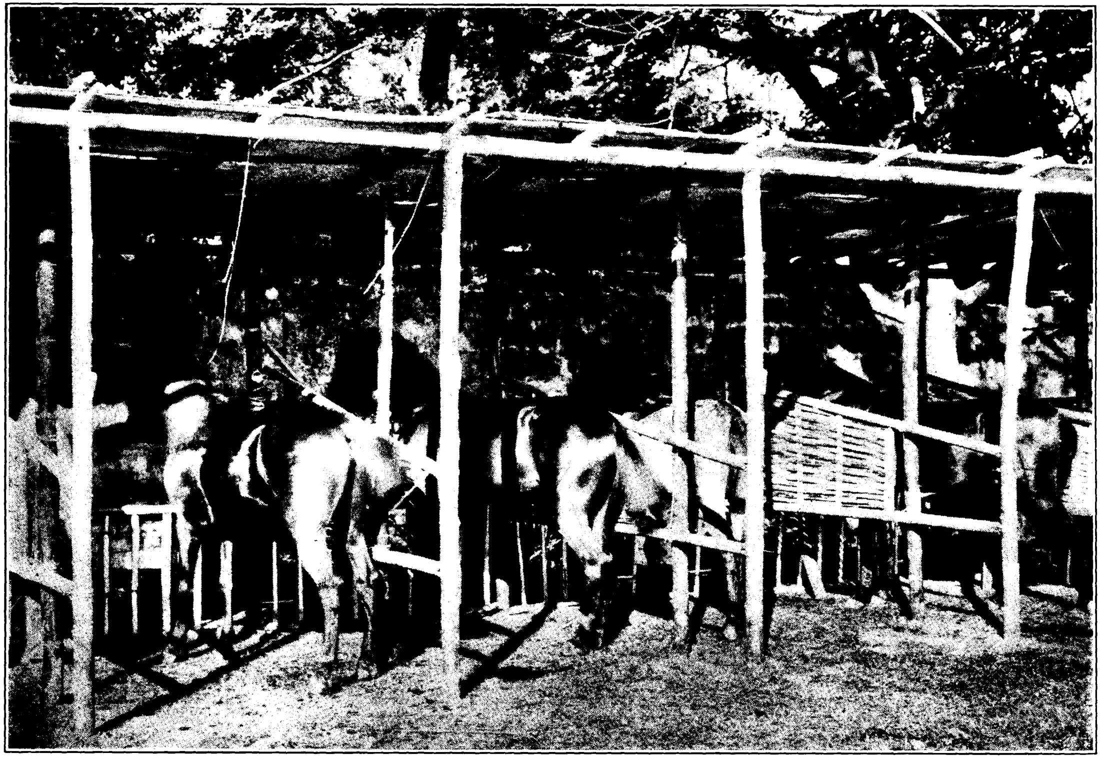
SUPERVISING VETERINARIANS.

Charles G. Thomson.
Stanton Youngberg.
Charles H. Leavitt.

VETERINARIANS.

J. B. Bell [1]
W. R. L. Best.
Victor Buencamino.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. L. Davis.
Charles H. Decker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.
A. H. Julien.
Harry F. Kern.
William A. Kliphardt.
Walter A. Korb.
Herman H. Ladson.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.

[1] On leave.



Horse sheds, Batangas live-stock show, Batangas, Batangas, January 16, 17, and 18, 1913.

THE PHILIPPINE

Agricultural Review

VOL. VI MARCH, 1913 No. 3

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

PROVINCIAL FAIRS.

There has recently been held in the municipality of Batangas a very successful live-stock show, a report of which is published in this number of the REVIEW. It appears that some exceptionally fine animals were exhibited at Batangas and that great interest was taken by the people of the province in this show.

In provinces other than Batangas preparations are now being made for the holding of provincial fairs; in the city of Manila the annual Carnival has just been held; and, as a matter of fact, throughout practically the entire year we find that provincial or municipal shows and expositions are either being prepared or are being held in some part of the Archipelago. Inasmuch as these fairs are coming to occupy such an important place in both the social and the industrial life of the Filipino people, it is highly desirable that they be so organized and so managed as to yield results commensurate with the expenditure of time and money which they entail.

We believe that the provincial fairs, properly managed, are well worth all that they cost. They serve to develop a spirit of good feeling and of coöperative effort, they encourage competition, and they are a decided stimulus to various lines of industry. It is probable, however, that a great deal can be done to develop and improve the fairs that are now being held.

At the present time there is altogether too much diversification of interests in our provincial "fiestas." An athletic meet in one locality is followed by a corn demonstration at some other place with possibly a live-stock show in an adjoining province. It should be possible, at least in some instances, to effect a combination of these several features in one fair of sufficient magnitude to attract substantial support from different Government bureaus and from commercial houses in Manila. Such support would tend to reduce the cost of carrying on the fairs and would largely increase their value as educational and industrial enterprises.

There are certain features of any fair or exposition, the satisfactory arrangement of which is often a matter of some difficulty.

We refer particularly to the classification of live stock and of agricultural exhibits, and to the judging of such exhibits. In its connection with various fairs in different parts of the Islands the Bureau of Agriculture has had occasion to give considerable attention both to the question of classifying as well as to that of judging live stock and agricultural products. In all cases where the promoters of provincial fairs will communicate with the Bureau of Agriculture, suggestions regarding suitable methods of classification will be gladly furnished, and ordinarily, employees of the Bureau can be detailed as judges.

It has been suggested that several adjoining provinces might well unite in holding an annual inter-provincial fair. If this were to be done it would be possible to hold larger and better fairs, and it would tend to develop a spirit of inter-provincial coöperation as well as that of friendly competition. There is ample evidence at hand as to what can be done in this direction in athletics; we believe that equally satisfactory results can be obtained along other lines.

If our provincial fairs are to become a permanent institution they must provide features which will attract all classes of people in the community and they must also show results of permanent value. A combination of athletic contests, a live-stock show, agricultural and industrial exhibits, and practical demonstrations should furnish a sufficiently varied and attractive programme, and one that will guarantee the general support of the people. If the fairs are well organized and properly managed they can hardly fail to be an important factor in the industrial development of the provinces in which they are held.

BUREAU OF AGRICULTURE CIRCULAR No. 19—MAIZE PESTS.

[CIRCULAR No. 19. Manila, P. I., January 24, 1913.]

MAIZE PESTS.

By C. R. JONES, *Entomologist.*

GENERAL STATEMENT.

The larvæ of three distinct species of the family Noctuidæ have thus far been found injurious to maize in the Philippines. Two attack the leaves only, and the other attacks the growing bud or tip. In no case have the outbreaks been reported until the damage had been done and the larvæ were ready to pupate. As a general thing, severe outbreaks are exceptional and occur only in abnormal seasons such as the one just past; however, more or less damage is done from year to year by these worms. The injury varies with the locality, although in many cases the young cornstalks are eaten down to the ground, necessitating the replanting of these fields. Local infestations are rather general, traces of these "worms" appearing in nearly all the fields of the section invaded. With regard to the Islands as a whole, a very general infestation seemed to be prevalent throughout the Visayan Islands in 1912, and this pest may be common in other parts of the Archipelago, although reports to this effect have not been received by the Bureau of Agriculture.

LIFE HISTORY.

The adults of the maize "worms" are small dark or brown moths and belong to the *Lepidoptera,* family Noctuidæ. They are not seen during the daytime as they hide under blades of grass and in other secluded places. At night they feed and deposit their eggs on blades of grass and maize. The eggs hatch in the course of three to five days and the tiny larvæ begin feeding upon the leaves. The small size and the color of these newly hatched larvæ make them inconspicuous and the injury done by them is slight. As they develop in size, consuming in many cases the entire plant, they are noticeable; and as the food supply becomes exhausted they crawl about in search of new feeding grounds. The leaf-eating class (*Prodenia litteralis* Hamps., and

Spodoptera mauritia Boisd.) are of a black color. The budworm (*Chlorida obsoleta* Hubr.) is entirely green. When full grown the larvæ, measuring about 2 centimeters in length, leave the plant and enter the ground close to the stalk, form a small earthen cell, and in a short time pupate. The pupa is a slender reddish chrysalid from which the adult or moth emerges a few days later.

INJURY.

It is impossible to definitely state the amount of damage that will be done by these insects as this varies from a slight defoliation to a complete destruction of entire fields. The extent of the injury depends upon the age of the maize attacked and the seriousness of the outbreak. Climatic conditions must also be taken into consideration. Large plants resist the attacks better than smaller ones and new leaves are more promptly formed; although they apparently recover quickly, defoliation retards the growth of the stalks and is thus detrimental to the formation of the grain. From this it will be seen that these caterpillars, besides completely destroying young plants, which necessitates replanting, also diminish the yield of grain; thus control of the pests is highly desirable.

CONTROL.

The most satisfactory means of controlling these pests is by the use of arsenical poisons. Of these arsenate of lead and Paris green will give the best results. In fields where these poisons are used care must be taken not to let carabaos or horses graze, as there would be great danger of poisoning them.

The poisons may be applied in either dry or liquid forms. Dry applications are better as the only apparatus needed is a cloth bag, which is used as a receptacle for the poison. Liquid application necessitates spraying apparatus to be effective. Arsenate of lead is preferable to Paris green as the latter when applied in excess has a tendency to burn and destroy the plants; the former has no burning qualities and the plants may be covered with it without fear of injury.

These poisons should never be applied at a concentrated strength but should be reduced by mixing with four or five times their weight of flour or air-slacked lime. This will reduce the cost of the applications and be just as effective.

By means of a stick with a bag on either end (fig. 1) one may effectively apply the poison to two rows at once by simply jarring the stick when the bags containing the poison are over the plants.

As the caterpillars are general feeders and are found extensively upon grass around the edges of the fields, it is a good plan to apply the poison to these places, but this grass must not, after poisoning, be used as feed for animals.

Another good method in the application of these poisons is to mix 50 pounds tikitiki (rice bran) with 1 pound of the poison. This mixture, if dropped on the ground around the plants, will be eaten by the larvæ and will result in their destruction. By mixing burned sugar and water with this poison bait its effectiveness will be increased and the larvæ will be attracted from considerable distances.

Fig. 1. Method of applying poison to maize for maize "worms".

Paris green is preferable to arsenate of lead in mixing a poison bait as by use of the latter the appearance of the mixture is not changed, while the former gives the mixture a greenish color and there is less danger of using the poisoned tikitiki for any other purpose than that for which it was prepared.

In the work in Cebu last June with the use of poisoned baited innumerable larvæ were destroyed; as high as twenty were found around one bait ball.

In this connection it may be stated that collecting the larvæ and carrying them off the field—a custom arising from a superstition as to the origin of these worms—is of very little benefit, as these pests gradually return to the corn fields if they do not find suitable food in the place to which they have been taken.

BUREAU OF AGRICULTURE CIRCULAR No. 20—THE MANGO BARK BORER.

[Circular No. 20.]

THE MANGO BARK BORER.

(*Plocæderus Ruficornis* Newm.)

By C. R. JONES, *Entomologist.*

During October, 1912, our attention was called to an insect attacking the mangos in the suburbs of Manila, and it was found that many of the finest specimens of these trees had already been killed and scores of others were dying from the attacks. This insect was identified as *Plocæderus ruficornis* Newm., a comparatively large Cerambycid beetle.

So far as we know there is no other insect capable of causing so much injury to the mango industry as this. Recent information indicates that the pest is not confined to Manila, having been reported from Baliuag, Bulacan; Pontevedra, Occidental Negros; San Pablo, Laguna; and Lamao, Bataan.

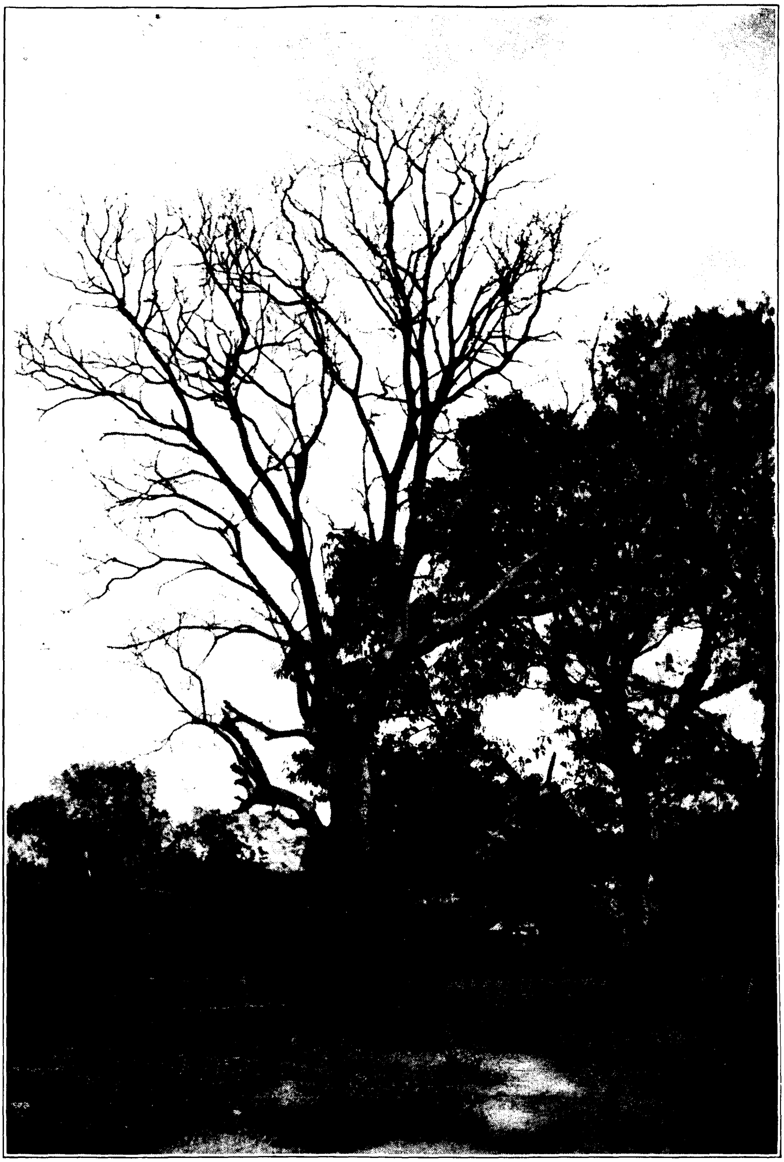
Unfortunately it is difficult to note the attack of the insect until the tree has begun to show serious signs of infestation, such as the slight raising of the bark on the injured areas caused by the irregular tension over the larval burrows. On account of the first two stages of the insect being passed entirely beneath the bark of the trees, the first symptoms the casual observer may note are the dying of the branches on that side of the tree which has been attacked, or in case the entire circumference of the trunk has been infested, the gradual shedding of the leaves and finally the death of the tree itself. Though probably one year is required for the life cycle of this beetle, this apparent advantage to the tree owner is offset by the fact that the female beetle can fly several kilometers and may deposit the eggs in several or many trees, perhaps in as many barrios.

While the possibilities of injury resulting from this pest have been clearly demonstrated in and about Manila and while it appears there is no more serious menace to the mango industry in the Philippines at present, it is not the intention of this circular to arouse unnecessary alarm but merely to bring to

Typical appearance of mango trunk attacked by bark borer.

Mango trunk showing effect of bark borer.

Some of the larvæ have entered the wood to pupate; the pupal cases are in evidence in the burrows.



Mango tree killed by bark borer; Manila.

the attention of the owner of every mango tree here the importance of this pest and the means of its control.

METHOD OF ATTACK.

Observations in the vicinity of Manila indicate that the beetle prefers the larger mango trees. In fact no case has yet come to our notice where a tree of less than ten years of age has been found infested. The trunk and underside of the larger branches are the points usually attacked. Only when the tree has become severely weakened are the tops of the limbs invaded. The first attack is frequently made at the base of the trunk, the larvæ working their way slowly upward and subsequent broods of larvæ beginning their attack higher up the trunk or out on the large branches.

The deplorable custom of slashing the bark of the mango trunks in order to force them into fruiting is in part to blame for the injury, since the older bark curling up slightly at the margin of these bolo, or cutlass, scars forms a very attractive place for the female to deposit her eggs and it is probable that in a very large percentage of the cases the first eggs have been laid in these old scars. Investigations show that only very seldom are adult insects found in the upper portion of the trunk and in the larger branches; it thus appears that the pest resorts to the latter portions of the tree only when the preferred areas at the base of the trunk have been more or less consumed by larvæ. Trees generally recover from the first attack since the bark is of sufficient thickness to allow the grubs to feed in it without seriously damaging the cambium layer and the young sapwood just beneath; when other attacks follow, however, the tree is frequently so weakened that its death results.

At first it was thought to be a hopeless task to determine any practical methods of control but by a careful study of the insect and its habits, the character of the injury, and the behavior of the tree under treatment indicate that the methods recommended in this circular will suffice to check, if not eradicate, the pest. The fact that a large number of the grubs are required to cause sufficient damage to result in the death of a large and vigorous mango tree is of special importance and the reduction of the number of these beetles below the killing point in any outbreak will render future damage comparatively slight. By a concerted action on the part of all mango-tree owners in the infested districts it is believed that this pest can be practi-

cally eradicated; on the other hand if the beetle is left to work its will without any attempt to reduce its numbers it follows that in the natural course of events the mango, one of the most important fruit trees of the Archipelago, may be practically wiped out.

LIFE HISTORY.

It appears that the eggs are deposited singly on the bark of, or inserted into crevices or wounds in, the base and lower part of the trunk. As soon as the young larva is hatched it begins to bore its way into the inner bark where in the soft layers of tissue lying between the sapwood and bark the entire grub stage is passed. Fig. 2, (*a*) and (*b*), shows the appearance of the full-grown larva. At first the presence of the young grubs can scarcely be detected from the outside since there is little or no frass extruded, but by carefully tapping with a bolo, or cutlass, over the infested area a more or less hollow sound will indicate the presence of the pest. Some larval chambers have been observed to cover an area of 40 centimeters long by 20 centimeters wide. Plate I indicates the appearance of the bark over an infested area.

When a supply of fresh bark is not at hand, as in areas previously infested, the grubs frequently feed upon the wood itself; the burrows in the wood are parallel with the bark except in the case of the pupal cavities which are usually at a considerable angle to the outer surface. Plate II shows the appearance of a very severely infested trunk from which the bark has largely been removed to show the burrows containing pupal cases in the wood. The larva is nearly white with the exception of the blackish head which is smaller than the following segment. The clypeus is brown and hairy. The mandibles are black and very strong, with the palpi light brown. The antennæ are pale with reddish brown tips. The body is cylindrical, translucent, and covered with minute red hairs except at the intersection of segments. Legs brownish red with claws light. Spiracles reddish brown, the first pair three to five times the size of the others. The very large, broad and flattened segment just behind the head is more or less hardened to form a shield-like organ; it is brownish red marked in three places on the back with a lighter color. The fourth to tenth segments bear protuberances amounting almost to tubercles and the arrangement of these gives those segments an angular or nearly square cross-section. The tenth and eleventh segments bear

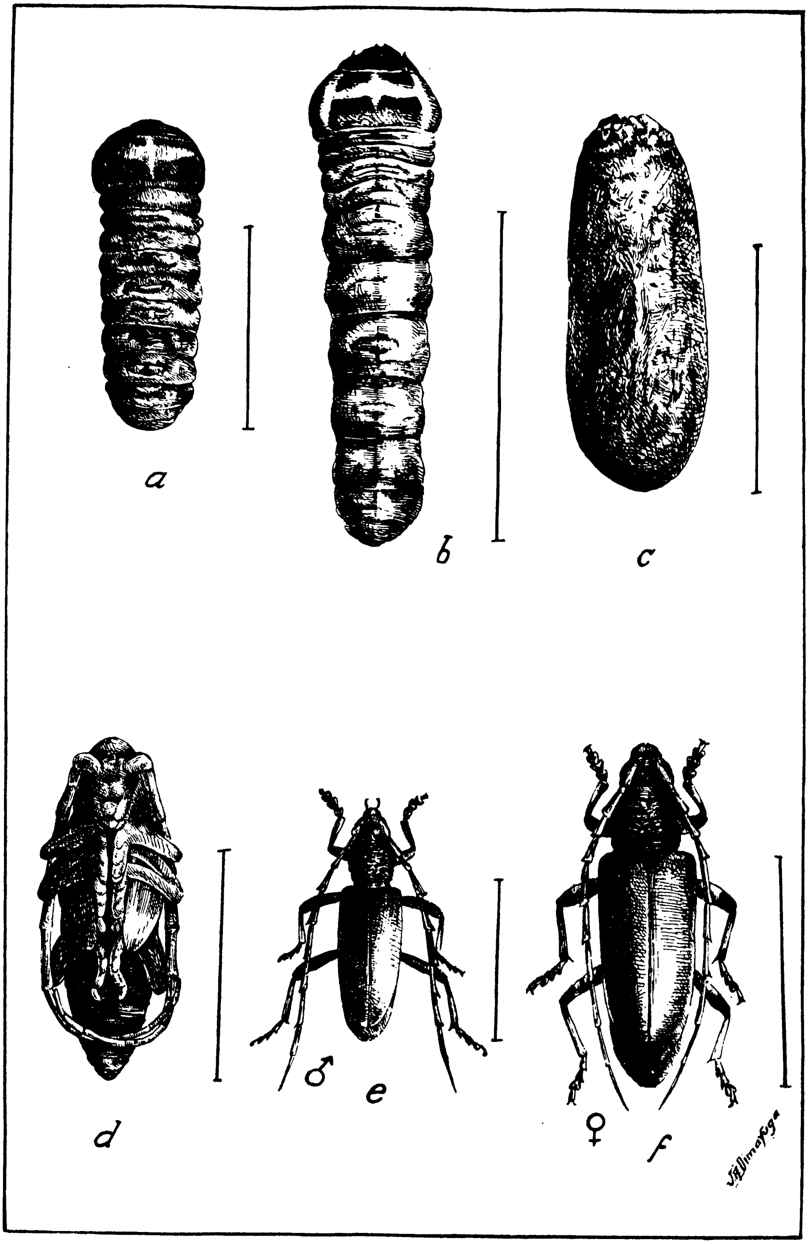


Fig 2. The mango bark borer (original).

(*a*) Larva (*Plocæderus ruficornis* Newm.) just after formation of pupal cell. (*b*) Larva (*P. ruficornis* Newm.). (*c*) Pupal cell (*P. ruficornis* Newm.) ; this is wholly composed of calcium carbonate. (*d*) Pupa (*P. ruficornis* Newm.). (*e*) Male adult (*P. ruficornis* Newm.). (*f*) Female adult (*P. ruficornis* Newm.).

folds of the integument of either side. One of the most characteristic facts in regard to the anatomy of this larva is the presence of two very long tubes lying just inside the skin and visible through the body wall; these tubes are at least four times the length of the body and doubled back at the head, they enter the alimentary canal about three-fourths its length from the head, but as the latter has one turn in it the ends of these tubes are very near the anal opening. From the general appearance of the location of these tubes, and the character of the surface of the roughened end of the pupal cell, it is highly probable that this solution is ejected through the anal opening itself. These appear to be homologous with the silk glands of the silk caterpillar but in the case of the insect in question they are filled with a condensed, flocculent, semi-solid secretion of carbonate of lime, which hardens in coming in contact with the air; from these tubes the larva constructs a highly distinctive pupal case which is in reality a marble cell.

At maturity the larva attains a length of 50 to 60 millimeters; the first body segment marks the greatest width; the head is only about 5 millimeters across.

When ready to pupate the larva forms a special cavity in the frass under the bark or in some cases eats into the wood itself. The calcium carbonate solution contained in the body tubes is now ejected to form a cell about the grub. As is common with similar larvæ, the body shortens considerably just before pupating, the length of this species in particular being reduced almost one-half. The cell (fig. 2 (*c*)) is strongly flattened and is more or less constricted about the middle; one end is larger than the other and the smaller is somewhat roughened. The thickness of this shell is from one-fifth to one-half of a millimeter. The following measurements based upon several hundred cells indicate the variation of the dimensions of this strange puparium which is nearly unique in the insect world as being composed entirely of mineral matter: Length 38 to 45 millimeters; width 16 to 18 millimeters; thickness 9 to 12 millimeters.

It is probable that quite a long time (say, one to three weeks) lapses after completion of the cell, before the pupa is formed, and also after becoming an adult considerable time is spent before the imago breaks through the shell. The pupa is about 35 millimeters long by 12 millimeters wide. At first it is of a semitransparent creamy white color but later certain portions of the body take on darker shades, the eyes becoming bluish black,

then the mandibles, palpi and legs turn brownish, and finally the wing cases take on the color of the adult.

The adult insect (fig. 2 (*e*) ♂, (*f*) ♀) is a rather conspicuous beetle from 23 to 45 centimeters in length with antennæ longer than the body. The body is a dull blackish color but the antennæ, as indicated by the specific name, are reddish brown. The thorax bears a strong sharp spine at each side and is minutely and irregularly corrugated on top; the legs are of the same rufous color as the antennæ with the exception of the joint between the femur and tibia which is blackish. The maxillary palpi are reddish but the mandibles are black. Like practically all the members of the Cerambycidæ this beetle stridulates when irritated or frightened. This habit is common to both sexes. The female is fully twice the size of the male but without other external anatomical differences.

The Tagalog name for this insect is "barbero."

METHODS OF CONTROL.

The principal difficulties encountered in the control of this pest are due to its habit of living beneath the bark which protects it against enemies during the larval period and also because of the parasite-proof pupa case. The insect being practically free from attacks by birds, lizards, or predaceous or parasitic insects, has an excellent chance of reaching maturity; in fact it would seem that every larva which succeeds in getting a burrow started under the bark is assured of maturity unless attacked by some fungus or bacterial disease. The only method of destruction therefore is a purely physical one. The necessary apparatus consists of a ladder, a rope, a spray pump, and a bolo or some other tool for removing the bark over the infested areas. The laborer simply cuts or pulls off the bark and removes all the frass, grubs, and pupa cases; a three-cornered hoe, or a short bolo blade fastened to the end of a bamboo pole may be used with excellent advantage especially on the branches and upper part of the trunk. After the burrows have all been cleaned out and the frass and decaying bark entirely removed, this area should be sprayed with a resin wash to prevent the entrance of fungi and wood-boring insects. For applying this protective solution an automatic spray pump should be used. A hand pump with a bucket will, of course, answer the purpose for ordinary cases but where large numbers of trees are to be

treated a knapsack or compressed-air pump should be used. The resin spray is, of course, not absolutely necessary.

The cost for treating large mango trees is calculated at 30 centavos per tree on a basis of 80 centavos per day per laborer. In the first experiments carried on by the Bureau in the suburbs of Manila, the city furnished six laborers for this work and 50 large trees in the districts of Singalong, Malate, and Paco were treated. Later the campaign was carried southward into Pasay and Parañaque. Trees that were treated in October have since been kept under close observation and in all cases they have shown indications that a complete recovery will ensue. Most of the trees responded very promptly to the treatment and are already growing new bark to cover the exposed areas. Even some of the trees that were practically girdled by the insects have recovered and are now blooming and bearing fruit.

It may be worthy of notice to mention the fact that the mere exposure of either the larva in its burrow or the pupa after removal from its cell is fatal. In fact it was found exceedingly difficult to keep larvæ alive after removal from their burrows during the rearing experiments at the Singalong experiment station. However, since there is some danger of a few stray live insects being left in the removed material, it is recommended that this *should be burned in a heap.*

SUMMARY.

The mango bark borer, while a comparatively unknown pest outside the vicinity of Manila, is exceedingly dangerous, largely on account of its feeding habits which make detection difficult. The beetle has, so far as we know, no natural enemies, being fully protected both in the larval and pupal stages. Physical remedies are, therefore, necessary, such as the removal of larvæ and pupæ from their burrows by hand.

Spraying the infested area of the trunk and limbs after thoroughly freeing them from the pest is recommended. Some spray which will not injure the tree itself but which will protect the exposed surface from fungi and insects that might attack the bare wood is recommended. The ordinary resin wash,[1] made by dissolving resin in an alkaline solution, is the best.

[1] See Bureau of Agriculture Circular No. 12.

THE SITUATION IN THE CITRUS DISTRICT OF BATANGAS.

By P. J. WESTER, *Horticulturist.*

Late in the year of 1911 the attention of this Bureau was called to the outbreak of a "blight" among the citrus trees in the citrus region of Batangas. Under instructions from the Director of Agriculture, the writer proceeded there November 9 and spent several days in the citrus district making observations which were submitted in a report the same year. The orange growers themselves, while aware of the condition of the trees, seemed rather apathetic in regard to seeking a cure at that time.

During the past year the trouble has become greatly aggravated, and, at the request of the Director of Education, the Director of Agriculture ordered the writer to again visit the citrus district in November, 1912. Altogether three separate trips were made in the investigation of the trouble and in securing typical photographs. On one of these trips made in November, 1912, the writer was accompanied by Mr. P. W. Graff, pathologist of the Bureau of Science. The writer wishes to acknowledge his indebtedness to Mr. George Whiting, supervising teacher, Santo Tomas, Batangas, for his assistance and aid which greatly facilitated the investigations.

The coconut, manufactured into copra and allied products for export, is, of course, preëminently the most important of the Philippine fruits, the banana is unquestionably the most important fruit supplementing the dietary of the Filipino, and the mandarin (*Citrus nobilis* Lour.), commonly called "naranjita," and the mango, furnish the most popular desert fruits in the Archipelago. The banana is the most universally planted, while the others are more or less localized. Trees of this species are, of course, found in most provinces, but, commercially speaking, practically the entire supply of mandarins comes from four towns in the Province of Batangas, Tanauan, Santo Tomas, San Jose, and Lipa—important in the production of mandarins in the order of their enumeration. By far most of the fruit is

grown in the district within the jurisdiction of Tanauan and Santo Tomas, extending eastward to Lake Taal.

Before the appearance of the coffee blight Lipa was the center of the Philippine coffee industry, and the spacious and solid houses and "camarines" seen here, many in ruins now, bear witness to the extent of the activity that once made the city a center of wealth and culture; even yet Lipa ranks as one of the most populous of the Philippine cities.

According to Mr. Whiting, who has compiled information relative to the industrial history of several towns in Batangas, Santo Tomas and Tanauan were once the center of wheat culture in the Philippines, and wheat continued to be the principal crop in the country adjacent to those towns until in the seventies, when a "blight" attacked the wheat, and, whether a disease or caused by insects, the trouble became so serious that wheat culture was abandoned, and all that remains is the ruins of the one time active flour mills. By the time this calamity struck Tanauan and Santo Tomas it had been noted that mandarins succeeded very well in the district, and in an attempt to build up another livelihood for the inhabitants an ordinance was passed by the Spanish government that required every landowner to plant yearly a certain number of mandarin trees. This ordinance remained in force for some years with the result that thousands of young trees were propagated and set out, and thus the "naranjita" groves of Batangas came into existence.

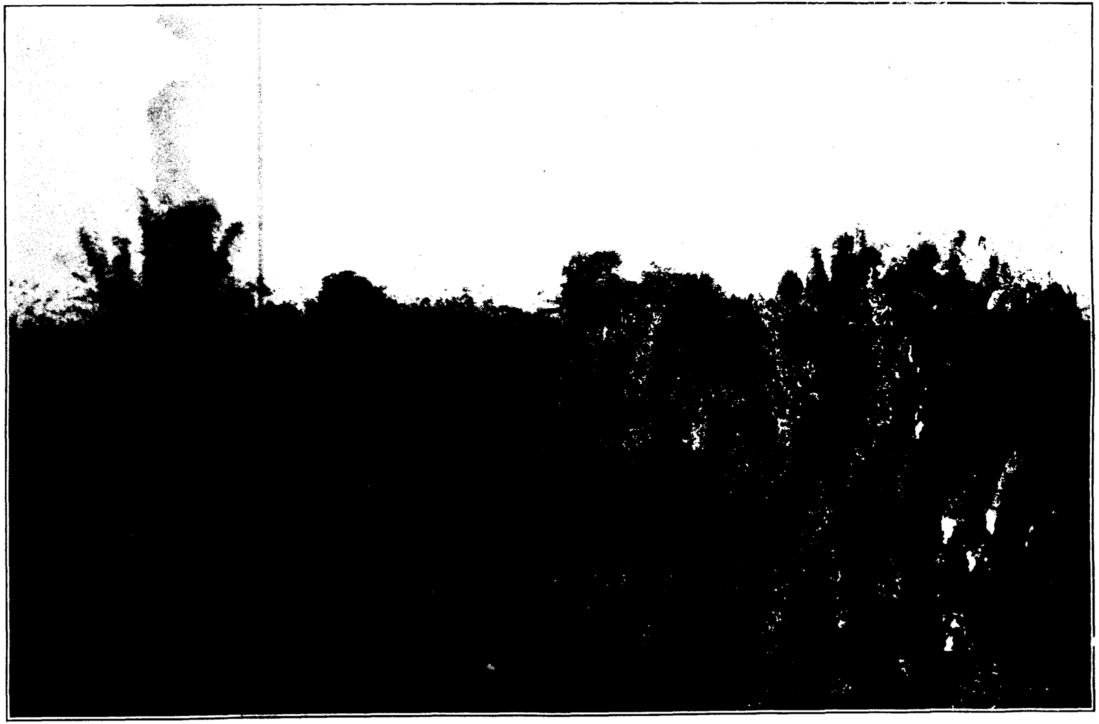
Mandarins are planted almost to the exclusion of the other species in the genus, though there are also a few oranges; the lime, calamondin, pomelo, cabuyao and lemon are very scarce; a few trees exist of a citrus fruit called "Tizon," which is presumably a natural hybrid between the orange and the mandarin.

The rearing of the plants and the culture of the trees subsequent to their planting in the orchard is simple in the extreme. Budding and grafting are known, but it is doubtful if many people realize the advantages of these operations, and excepting a few that have been imported there are no budded trees in the province. The plants are grown crowded in the nursery and transplanted into the orchard usually without any pruning of any sort and left to themselves. Rice, corn, and various vegetables are grown as subsidiary crops between the trees until they have attained their full growth, or the land is used as a pasture ground; after the year's crop from the "auxiliaries" has been gathered the weeds are usually allowed full sway until

Trunk of mandarin tree (*Citrus nobilis* Lour.) affected with barkrot, Santo Tomas, Batangas.

Same as Plate V, the flakes of dried bark having been brushed off exposing the sores made by barkrot.

Portion of branch of orange tree (*Citrus aurantium* L.) attacked by barkrot, exposing scars after brushing off the dried bark, Santo Tomas, Batangas.



A typical young mandarin grove in Santo Tomas, Batangas.

Note the very unthrifty condition of the trees and the growth of weeds.

Dying mandarin grove; now a common sight in Santo Tomas and Tanauan, Batangas.

Photographed November, 1912.

the land is again planted. In the old groves the land is either allowed to grow up into weeds which are cut down once a year, in the dry season, or sometimes it is planted to "Madre de Cacao" (*Gliricida maculata*), which also is cut annually and the leaves and stems left for mulch. Little or no cultivation appears to be in vogue in a grove of fullgrown trees, excepting such as is given by the ever present "barrio" hog. No pruning worthy of the name is ever practiced and the dead wood in the trees is swarming with borers.

A number of scale insects are found but rarely in such numbers as to seriously impair the vitality of the trees. Here as in some parts of Florida and the West Indies, predaceous fungi and insects seem to have the scale situation well in hand in most instances. A species of *Loranthus* sometimes escapes from the forest and is parasitic on the citrus trees but in most cases it is held well in check. If allowed to gain a good foothold this plant works considerable injury to the hosts and finally kills them.

No one who was within range of vision or hearing is likely to forget the eruption of Taal Volcano January 29, 1911. This volcano is situated on an island in Lake Taal, a few miles to the east of the citrus district in Batangas. During the night of the eruption, which but for the rescuers would have anihilated all life on the island on which the volcano is located, the wind was in an easterly direction and mud and ashes were carried across the lake and deposited on the mainland. Near the lake this deposit was, according to Mr. Whiting, so heavy that many trees were more or less defoliated while farther east towards Mount Makiling the damage was trifling or none at all.

The severe drought during 1911, extending over a large area of the Philippines including Batangas, is also still fresh in the memory of all in the Islands.

Two such calamities, one following the other, would have exerted a malign influence upon trees in good condition and well cared for, and it is then only natural that under existing circumstances the shock received by the citrus trees in Batangas should be greatly accentuated. Also the presidente in Tanauan stated in November, 1911, that the year's crop was only 10 per cent of that of the year previous to the eruption of Taal, and a few of the old trees were then dead or sparsely foliaged, particularly near the lake. At that time quite a number of trees were in the active stages of barkrot, though taking everything into consideration, its attack seemed comparatively insignifi-

cant, the general unthrifty aspect of the trees being by far the most serious condition of the groves.

The following extracts from the writer's report of November, 1912, illustrate the situation in the citrus district as it stands to-day:

> The past summer with abundant rainfall has been a favorable one for the growth of the citrus trees. Nevertheless the general condition of the groves is decidedly worse than a year ago. A large number of trees are dead or beyond recovery that were in fairly good health a year ago and a large majority are in a poor and unthrifty condition. As is frequently usual under similar circumstances the trees during the current year bloomed and set a heavy crop of fruit which, of course, has served to devitalize the trees still further, and from all causes combined it is conservatively estimated that 50 per cent of the bearing trees in Tanauan and Santo Tomas are now beyond recovery.
>
> The entire absence of rational care of the trees coupled with the shock they received at the time of the eruption of Taal which was followed by an unusually dry summer is believed to be responsible for the premature death of a majority of the trees and the death of a very large number has been hastened by the outbreak of the disease already referred to in my last year's report. However, the disease at present is is not so prevalent as it has been for some months past as evidenced by the numerous scars of the affected trees that are now in the process of healing.

Very few cases of barkrot and those in a mild form, were found in Lipa; San Jose was not visited, no complaints having been received from this municipality.

The barkrot makes its appearance on the trunk and larger branches frequently 1.5 meters or more above the ground. The first indication of the presence of the malady is the oozing out of sap from the bark and the formation of a putrid sore at the point of attack, the bark and cambium layer decaying, giving off a fetid odor. The putrifying sap soon attracts a number of insects which feed upon the decaying matter and these are commonly believed by the people to be the primary cause of the sores, though it is very evident that they are of secondary importance. At most their presence is irritating and delays the healing of the sores. These are more or less irregular in outline and area, ranging from the size of a 10-centavo piece to sometimes, in very aggravated cases, girdling the entire trunk or branch; as the decay is arrested, in an attempt of the tree to overcome the disease, the sore dries up and new wood is formed around the edges; the bark also dries up and sloughs off. (Plates IV, V, and VI.)

The disease has much in common with the footrot that has been so destructive to citrus trees in many parts of the world,

yet it is quite distinct from that malady in that it extends from the ground well up into the tree, and also in the way it sheds the dead bark when the sores heal up; it also does not attack small trees, which are not exempt in an outbreak of footrot; and finally, the mandarin, which has been considered practically immune to footrot, is here attacked in common with the orange and calamondin. While in common with the gummosis it may be physiological in origin, it is distinct from this disease in not gumming.

Mr. Graff, who secured fresh material for study at the time of his visit, has thus far failed to find any indication of the presence of a fungus or bacterium that might be the cause of the disease.

Recommendations.—Neglect being unquestionably the principal cause of the death of the trees, better culture is the first and most essential step to take in the renovation of the groves and in the eradication of the disease prevalent there. The following suggestions are offered to the citrus growers:

1. All dead trees (including the larger roots, trunk and branches) and those beyond recovery should be removed from the grove and burned.

2. All dead wood and weak or dying growths should be carefully pruned out of the remaining trees and burned. The decayed areas of bark and wood should be cut out of those trees affected with barkrot and also burned, and the wounds lightly painted with a solution of crude carbolic acid and water mixed in equal parts (1 liter of water to 1 liter of carbolic acid). *Great care should be taken not to apply so much of this mixture that it runs down over the sound bark or to spread it over the sound portions of the tree for it is extremely poisonous and is deadly to all living plant tissues.* The above remedy has been applied successfully in the control of the footrot in Florida. The mixture is cheap and easily made and it is sure to destroy any fungi or bacteria which might be the cause of the trouble; should the malady be merely physiological, it can do no harm and it will keep away all injurious insects which might enter the wounds and irritate the growing tissues, and if applied properly, it is absolutely safe.

3. All weeds under the trees should be cut down and piled around the trees for mulch. Shrubs, etc., had best be removed and burned. The clearing of the ground should be followed by a shallow plowing of the land—*not too close to the trees* as the roots might be injured—just before the advent of the

rainy season, and the land planted to cowpeas or some other legume as a cover crop.

4. An application of a complete artificial fertilizer, 3 to 6 kilos to each bearing tree, according to size, would also aid in the recovery of the trees. This should *not* be applied near the large crown roots and the trunk, but be scattered thinly throughout the grove.

The purely cultural recommendations apply to all citrus trees in the region referred to, for there are exceedingly few that are in good and thrifty condition at present because of neglect and ill usage. It is safe to say that with the same lack of care that is accorded the citrus trees in Batangas, the citrus industry in Florida and California would be wiped out of existence in the course of a few years. Were it not for the soil and climatic conditions, which are exceedingly favorable for the development of the citrus trees in the region under consideration, there would be no citrus industry there. However, the patience of the trees and that of a kind Providence seem now to have become exhausted and the writer has no hesitation in saying that *unless the growers immediately take concerted action, abandon their slovenly ways of cultivation and apply modern methods in the care of their trees, it is a question of time only when the citrus industry of Batangas, like that of coffee and wheat, will be but a memory of the past.*

THE BATANGAS LIVE-STOCK SHOW.

By C. W. Edwards,
Acting Chief, Division of Animal Husbandry.

To the horticulturist the term Batangas signifies the famous green orange; to the agriculturist, the many varieties of upland rice; but to the lover of animals the term has, from early times, been almost symbolical of a horse, possessing certain qualities so superior to the average of other localities that it may be considered a specific type. It is true that this province at present can not boast of the numbers or the proportion of first class individuals, as was once the case, and of late there may have been a tendency on the part of some to question her vaunt of supremacy in horse production. However, a visit to the recent live-stock show held in Batangas the 16th, 17th, and 18th of January, 1913, would have convinced the most incredulous, leaving no doubt in the mind as to the correctness of this assertion. That the people are zealous in maintaining their reputation by continual improvement was forcibly evidenced by the thousands in daily attendance at this exposition, and in fact it is doubtful if the town of Batangas has in previous history ever witnessed as large a gathering.

The idea here followed of planning the opening date of the fair so as to occur simultaneously with the town "fiesta," or holiday, is a feature that might well be copied by the other provinces in the arrangement of subsequent events of this nature. In connection with each fiesta there are, aside from the primary religious features, always accessory amusements, provided by the cock-pit or other forms of diversion, that may well be substituted by features of educational and material benefit.

The entire number of officials who labored toward the successful accomplishment of this, the first live-stock show of the province, are deserving of only the highest praise. If there is one among this number, however, to whom credit is due over the others for the marked success of this venture, it is the acting provincial treasurer, Mr. E. T. St. Clair. With him the plan had its origin, and throughout the period of preparation

his untiring efforts furnished the impetus that kept the work in progress to final completion in every detail; his labors would have counted for naught, however, had he not received the hearty coöperation of provincial and municipal officials and the many other coadjutors who belong to a class of individuals who are not content with the performance of simply the absolutely necessary routine duties, but who are keenly interested in the progress of their province and put forth every effort looking toward advancement. Among these the provincial governor, the Honorable Pablo Borbon, is deserving of special mention for his active interest, enthusiasm, and efforts instrumental in the securing of the generous appropriation of ₱1,500 to be allotted as prize money to the winners in the various classes.

The most convincing proof of the meritorious work of the committee in charge of general arrangements and organization was the complete success of the fair. The members of this committee were the following:

The honorable the provincial board and Messrs. Belmonte, Tolentino, Sweet, Jose Villanueva, Felix Villanueva, and Rosales.

The details of classification and arrangement of entries was the work of Mr. Melecio Arceo and the several employees under his direction.

The walled courts adjoining the provincial building were admirably adapted as exposition grounds, and the temporary stables and other buildings for the various classes of live stock to be exhibited were constructed under the general supervision of district engineer J. W. Graham.

On the opening day, as the great crowd thronged into the city from every direction and the list of entries comprising the best of Batangas stock were checked up, the success of the first Batangas live-stock exhibit was no longer in question.

In the afternoon the preliminary trial heat in the running race was run over the two-thirds-kilometer course, which had been constructed on an open area to the north of the town, well adapted for this purpose. It is doubtful if the number and enthusiasm of the throng of spectators who witnessed this event has ever been equaled, even at the popular Manila speed park, "San Lazaro." The main preliminary race was won by a gray stallion, the property of the provincial governor. The races of this day as well as those of the two days following were held under the direction and supervision of the senior inspector of Constabulary, Major Sweet; Mr. Luna, the third

member of the provincial board, ably officiated as starter. The arrangement of classes and the successful manner in which they were conducted met with the hearty approval of participants and spectators alike.

The second day opened with a civic parade, under the direction of Rufino Canent, headed by the managing directors and the neatly uniformed Santa Rosa band, and followed by a company of Constabulary, while in the line were the gay turnouts of various officials and prominent individuals, the members of a number of local organizations, and the many choice animals of the exhibit.

In the afternoon occurred the second preliminary heat of the running race. The main event of the day at the course was the single harness trot or pace, in which a splendid iron-gray stallion owned by F. Martinez, of Balayan, was an easy first.

The forenoon of the concluding day witnessed the finals in the running races, and a very interesting $1\frac{1}{3}$ kilometer race of pacers and single footers under saddle.

In the afternoon, as a fitting climax to the exposition, the prize winners in the various classes were arrayed on the town plaza and the people gathered to hear the appropriate remarks of the provincial governor, and to witness his presentation of the prizes to the many successful contestants.

It might, perhaps, be possible to conduct a show of this nature in other localities in which the number of entries would exceed the number presented at this fair, but it is very doubtful if the average high excellence of individual entries could be surpassed or even equaled.

The class of pure native stallions was a particularly select lot. Every one of the eleven entries was a top-notcher and it was no easy task to choose the winner, but the laurels were finally bestowed upon a beautiful bay stallion with dark points, the property of Sixto Africa of Lipa. This section presented specimens of a class of horse embodying in a remarkable degree the qualities and characteristics typifying what is known as the "Batangas type," an animal of good size with plenty of width and depth of body, and showing remarkable style and action.

The class of pure native brood mares was first in number of entries, there being eighteen in all, representing nine municipalities. The trim, dark iron-gray mare owned by Miguel Lor-

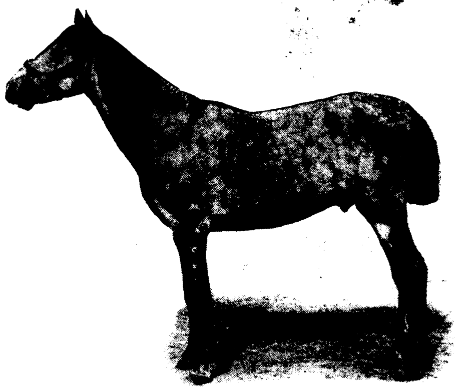
zano of Lipa won the blue ribbon in this class, and a bay filly, the property of Pablo Dimaano, a close contestant for first honors, was placed second.

Perhaps the most interesting and instructive feature of the horse section was the large number of grade or so-called "mestizo" entries presented. With one or two exceptions these animals were the get of the Bureau of Agriculture sires, which have been stationed in the province from time to time. The results of early campaigns with these stallions have awakened the people to an appreciation of the value of this work, and within the past year a permanent breeding station has been established by the province near the town of Batangas where the Bureau of Agriculture now maintains one Thoroughbred, one Arabian and one mestizo stallion, and one Berkshire boar. The people are taking so deep an interest in these animals, and the demand for their services has been so heavy, that it is the intention to furnish them with additional stud stock in the near future. The permanent-station plan is a great improvement over the campaign method, as it allows opportunity for the proper care of the animals, suitable area for the growing of forage, and allows of the establishment of a paddock where the mares, which are brought for service, may be held for trial period.

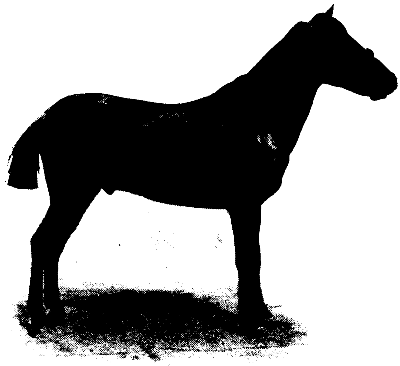
Among the many mestizo entries, a majority were the get of the Thoroughbred stallion Handrail. This stallion, of Hannover stock, imported by the Bureau in 1904, has proved one of the most potent and satisfactory of the sires used in public breeding work. The prize winners in the mestizo mare and the mestizo stallion classes were both sired by this animal; the former, a beautiful, white-stocking bay, the property of Manuel Dimaano, of Lipa, although a little off in color, is a most excellent animal. The mestizo stallion, a superior first-cross type, the property of Mr. Felino Kàtigbac of Lipa, won his first blue ribbon at the Live-stock Exposition at Manila last year.

The most concrete object lesson of the horse division was furnished by an entry in the class of native mares with mestizo colts at side. In this particular case a promising Handrail colt, very pleasing in appearance, of only ten months of age, measured an inch more in height than his native dam.

The class of mestizo or native sires shown in harness brought out some very good material, the prize being awarded to a well matched team of bays of good performance, the property of Judge Mariano Cui.

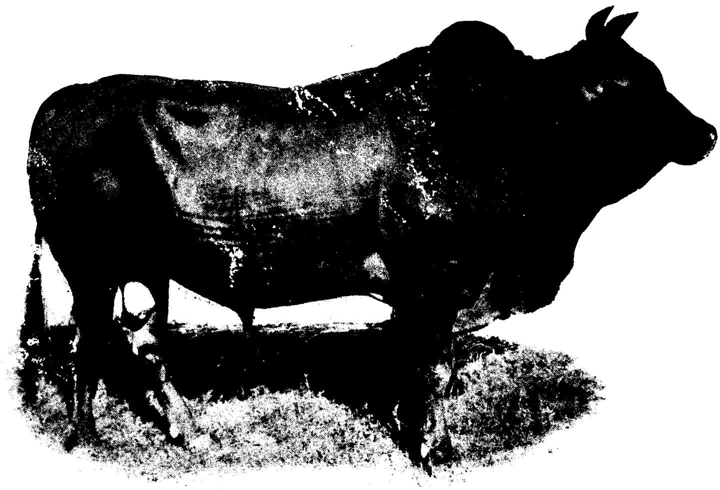


(*a*) First prize, Class H, mestizo stallion.
Owner, Felino Katigbac, Lipa. Sire, "Handrail;" dam, native mare.



(*b*) Mestizo stallion.
First prize in Class E, "horses in single harness." Second prize in Class H, mestizo stallion
Owner, Bartolome Katigbac, Lipa.

(*c*) Dark iron-gray native mare, 52 inches.
Winner of first prize in native-mare class. Owner, Miguel Lorzano, Lipa.



(*a*) First prize, native bull, Class J.
Owner, Andres Moratilla, Taal.

(*b*) First prize, Class I, native cow and calf.
Twin calves in foreground, mother and full-grown male offspring. Owner, Vicente Amador, San Juan.

Although the cattle and carabao classes were not as well represented as were the horse classes, some very good individuals were shown. The winning entry under the class of native cows with suckling calf was a very good type of native dam with twin calves at side.

Among the classes of small animals some exceptionally good native sheep were shown, and a few pens of pure-bred poultry also warrant special mention.

The judging of classes took place in the forenoon of each of the three days of the exposition. The ribbons were placed by E. H. Koert and C. W. Edwards, of the Bureau of Agriculture, and Mr. Lemey, of the Quartermaster Department, Camp McGrath. The following is a list of classes with the respective prizes and winners in each class:

CLASS A.—Pure native brood mares:	
First. Miguel Lorzano, Lipa	₱75
Second. Pablo Dimaano, Lipa	35
CLASS B.—Pure native mare with mestizo colt:	
First. Juan Palacios, Batangas	75
Second. Julian Katigbac, Lipa	35
CLASS C.—Pure native stallions:	
First. Sixto Africa, Lipa	100
Second. Victor Templo, Lipa	50
CLASS D.—Teams in harness, either pure native or mestizo:	
First. Judge Mariano Cui, Batangas	150
CLASS E.—Horses in single harness, either pure or mestizo:	
First. Bartolome Katigbac, Lipa	75
Second. Felino M. Katigbac, Lipa	35
CLASS F.—Saddle horses, either native or mestizo:	
First. Julian Katigbac, Lipa	50
Second. Cipriano Africa, Lipa	25
CLASS G.—Mestizo mares:	
First. Manuel Dimaano, Lipa	100
Second. Isabelo Joya, Batangas	50
CLASS H.—Mestizo stallions:	
First. Felino M. Katigbac, Lipa	100
Second. Bartolome Katigbac, Lipa	50
CLASS I.—Native cow with calf:	
First. Vicente Amador, San Juan	50
CLASS J.—Native bull:	
First. Andres Moratilla, Taal	50
CLASS L.—Male carabao:	
First. Evaristo Zuño, Rosario	40
CLASS M.—Pair of sheep, male and female:	
First. Juan Palacios, Batangas	15
CLASS N.—Pair of goats, male and female:	
First. Ciriaco Mendoza, Talisay	15

CLASS O.—Pair of hogs, male and female, native, mestizo or imported:
First. Martin Collazo, Batangas ₱30
CLASS P.—Pair of native chickens, cock and hen:
First. Roman Lacsamana, Batangas 10
CLASS Q.—Pair of imported chickens, cock and hen:
First. Lee Rogers, Batangas 10
CLASS R.—Pair of turkeys, tom and hen.
First. Juan Palacios, Batangas 15

The races were as follows:

CLASS I.—Free for all, running.
CLASS II.—Mounted, trotting or pacing.
CLASS III.—Trotting or pacing in single harness.

The winners were:

CLASS I:
Sr. Gregorio Aguirre, Batangas, first place ₱100
Sr. Benedicto de Villa, San Juan, second place 40
CLASS II:
Sr. F. Martinez of Balayan, first place 50
Sr. Benedicto de Villa, San Juan, second place 25
CLASS III:
Sr. F. Martinez, Balayan, first place 60
Sr. Benedicto de Villa, San Juan, second place 30

POPULARITY OF BANANA FOOD PRODUCTS.

By O. W. Barrett,
Chief, Division of Horticulture.

After a decade or more of partially successful experiments in the manufacture and popularization of banana products, a definite market is now assured, at least in Europe, and we may expect to hear of numerous factories being established throughout tropical America and, let us hope, even in the Philippines, within the next few years.

Jamaica in the West Indies has been the mother, so to speak, of this industry and it is in that island where nearly all of the really important factories for handling bananas are now to be found. In the March, 1912, number of The Philippine Agricultural Review attention was called to the appearance on the market of several varieties of banana products; it seems, however, that recently several additional companies have entered into the business in Jamaica. From the Daily Consular and Trade Reports we learn that at least six factories are now in operation and two other companies are contemplating the erection of large plants.

The following quotation taken from the above-mentioned publication indicates clearly the present status of the business; the processes in use in the various concerns are, of course, more or less private, though for that matter Philippine conditions would necessitate the working out of special methods for handling the material here:

> The original factory, which has been operating about six years at Gayle, claims to have a secret process for making banana figs. A large factory at Montego Bay had its machinery made after its own designs in New York. Two other companies expect to patent their machines, which have been locally designed and manufactured. It is understood that the drying is done by hot air and that it takes 400 to 500 pounds of fruit to make 100 pounds of the figs. For a good many years experiments have been made in drying bananas, but it has been difficult to find a process for making a product that would keep well. Now that manufacturers are using a variety of machines and apparatus it is to be expected that the best process will

soon be known. Although worms are never found in ripe bananas, the preserved fruit, if left exposed, attracts insects and soon becomes infested with small worms, as is the case also with other dried fruits.

The food products manufactured are fig bananas or banana figs, cooking bananas, banana chips, flour, and meal. All the factories dry or evaporate the bananas whole without the addition of sugar, and yet they are sweet and palatable, like pressed figs, which they also resemble in color. At least one factory cuts the bananas into short pieces before drying or evaporating them, thus making a product that looks much like the dried figs of commerce. It seems that it would be well in order to make a distinction to call the bananas cut into pieces "banana figs" and those treated whole "fig bananas." What are known as "cooking bananas" are so thoroughly dried as to be hard, the color of these being almost white. Broken into pieces they form "banana chips," which not meeting with duties are imported to be ground into meal or flour in the country of consumption. In spite of the fact that the meal is said not to keep well, one Jamaica factory uses an American gristmill for grinding the chips. Another company has its own factory in London, to which it exports the chips to be ground into flour and meal and made into other preparations for market. A small booklet is issued there to set forth the dietetic value of banana foods as attested by British and German food experts and others; and there is added a list of products on sale, with recipes for their use, etc. These banana food products have been awarded many prizes, diplomas, and certificates of merit.

It seems that all banana food products are wholesome and nutritious. The figs are delicious and are likely to be preferred to real figs by many persons. The fig bananas cut into small pieces may be used like raisins to impart an additional flavor to cakes and puddings. The chips, after being well pounded or ground in a coffee or other hand mill, may be boiled and then used as an excellent breakfast food or for making delicious puddings. Gruel, porridge, and other preparations made from banana flour and meal, which are rich in easily soluble carbohydrates, are recommended for infants, invalids, and dyspeptics. The negro women of Jamaica use banana meal gruel as a substitute for milk for their infant children. The banana itself is one of the most wholesome and nutritious of fruits if eaten slowly when it is perfectly ripe (that is, just before it decays), but not when devoured only half ripe, as is often the case in the United States, which causes many persons to regard bananas as being difficult to digest.

It seems only necessary to make the value of banana food products known in order to create a large market for them. Already they are to a considerable extent popular in Germany and Great Britain, which have been taking the bulk of the exports of such products from Jamaica. . . . The Hawaiian Islands and the Philippines also seem to offer inviting fields for the profitable manufacture and exportation of banana food products.

An interesting feature in the comparative progressiveness of Europe and America in the line of adopting new foods, etc., is brought out in the statement that a large United States order was recently refused by one of the Jamaica companies by reason that it was under contract for shipment to Europe of practically its entire output. It seems that the combined capacity of the

Jamaica factories is only some three tons per day but this will probably be considerably increased in the near future.

The writer remembers with pleasure testing both at Key West, Florida, and Washington, D. C., a series of samples of banana products made by a Central American firm; moreover, he made numerous experiments (extending even to table tests) at the Porto Rico Experiment Station in the line of flours, meals, and coffees, from numerous varieties of bananas and plantains grown in that island; in Porto Rico, however, the only form of banana food in general use aside from the fresh fruits is a plantain flour from which a most wholesome gruel for invalids is prepared.

In short, then, we should remember that banana products can be very cheaply grown in the Philippines; that these foods may be very conveniently and safely stored, transported, and exported; that they are of very high nutritive value; and therefore that they can not be overlooked in any study of the social economics of these Islands. In short, the banana as a crop not only helps out very materially the precarious old one-crop system but also provides a very interesting subject for study by the future manufacturers and merchants in the Orient.

THE CALTHROPS.

By P. J. WESTER, *Horticulturist.*

There are many interesting vegetables, fruits and nuts used for food or for other purposes in the Far East which are but little or not at all known in the Occident. Not the least interesting of these is the Calthrop, or Chinese water chestnut (*Trapa bicornis*), by the Chinese known as "ling" and "ling kok," and which is annually imported from China into the Philippines in large quantities during July, August, and September.

The Calthrop belongs to the family Onagraceæ and is indigenous to central China, where it grows wild in many localities; according to Mr. Amos P. Wilder, American consul general at Shanghai, it is most extensively cultivated in the Province of Kiangsi.

In China the Calthrop is grown in shallow lakes, ponds, and canals. The year-old nuts are "planted" in the spring, a meter or so apart, by dropping them into the water; they succeed best at a depth of about 1.5 to 1.8 meters. The nuts germinate rapidly and soon the plants appear above the surface of the water, much resembling a "field" of the water hyacinth. The nuts are harvested in boats late in summer.

The accompanying illustration (Plate XII) conveys the appearance of the Calthrop better than any written description. The average weight of a "nut" is 6 grams, of which 5 grams constitute the kernel. This is white and starchy and of a pleasant nutty flavor, and is eaten raw, boiled or roasted.

The Calthrop is closely related to the Singhara nut, *Trapa bispinosa,* which is extensively cultivated in Kashmir, the northwest and central provinces of India. In Kashmir the Singhara nut is said to furnish food for 30,000 people during five months of the year. The Singhara nut is grown on marshy inundated land. The seeds are sown in January by being thrown in the water and pressed into the mud with the feet or with sticks. In June, just before the rainy season, the plants are thinned and transplanted, and the "nuts" are harvested in November and December.

As far as known the cultivation of either of these plants has never been attempted in the Philippines.

CURRENT NOTES—MARCH.

NOTES BY C. R. JONES, Entomologist.

FRUIT-FLIES.

Several months ago fruit of *Eugenia malaccensis* Linn., obtained in the market, was found to be infested by dipterous larvæ, which at first were thought to be of the Mediterranean fruit-fly (*Ceratitis capitata* Wied.), but upon determination they were found to be of the mango fruit-fly (*Dacus ferrugineus* Fabr.). These flies are quite common through Java, India, Ceylon and Amboina, as well as the Philippines, and cause considerable damage to fruit. They do not confine themselves to any one class of fruit, but are particularly injurious to the mango and citrus fruits. Over fifty species of the genus *Dacus* have so far been described from Malaysia.

A late shipment of *Citrus hystrix* DC. from Bohol contained numerous dipterous larvæ which have not as yet emerged, but which are in all probability of the above species.

TOMATO-LEAF BEETLE.

In the numerous gardens throughout Manila considerable damage is being done by *Epilachna vigentioctopunctata* Fabr., this insect belonging to the family Coccinellidæ, many of which are beneficial insects. This pest injures the tomatoes by feeding, in both the adult and larval stages, upon the upper and lower epidermis of the leaf. Infested plants are readily recognized by the brownish color of the leaves which curl up and eventually die.

The eggs of this insect are deposited in groups containing from 9 to 40 each. Adults have been observed to oviposit from one to three clusters of eggs almost daily over a period of sixty-five days. Observations were made on numerous isolated pairs of these insects and the eggs laid were recorded. Two females which emerged February 6 were noted to oviposit during the period from March 6 to May 15; the total number of eggs laid by these two insects was nine hundred and sixty in forty clusters. From this we see the rapidity with which this insect increases,

and as the adults move about promiscuously, considerable damage can be done.

This pest may be controlled by a proper application of Paris green or arsenate of lead.

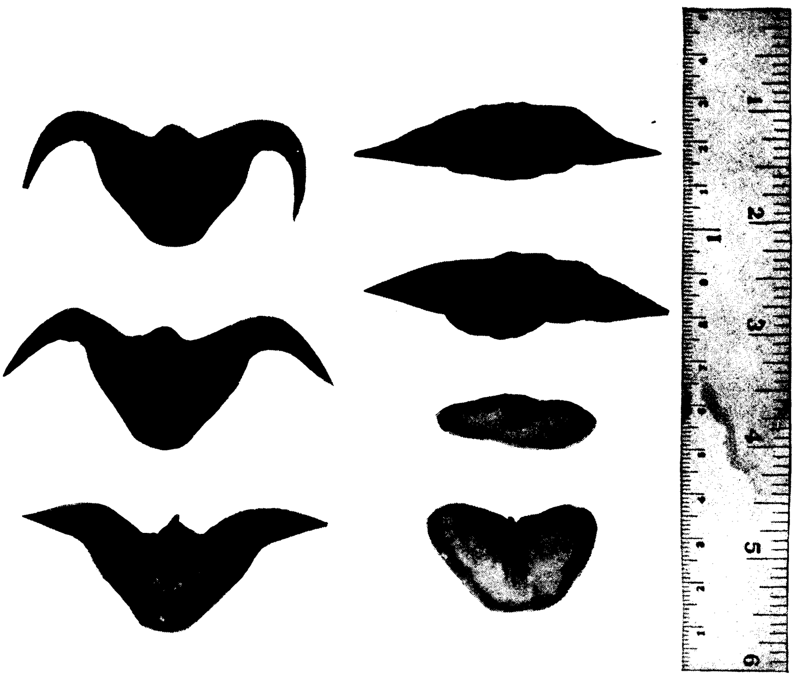
MAIZE STALK-BORER.

Considerable damage is being done to young maize by the maize stalk-borer, *Pyrausta vastatrix* Schultze. This insect belongs to the family Pyralidæ and injures the plant by boring into the stalk at the joints, where the insect spends both larval and pupal stages. As this pest feeds on the interior portion of the plant it is not amenable to insecticidal treatment such as would be effective for other insects, hence the only method of control would be by parasites, trap lights at night for the adults, or destruction of infested stalks. This pest so far has been reported only from Luzon.

LOCUST SITUATION IN THE VISAYAS.

Outbreaks of locusts in the Visayan Islands are now well under control. At present Iloilo has only three municipalities that have hoppers. Cebu, which up to January 1, had a total infestation, is now practically free from the pest. Reports from the assistant entomologist who is now in those Islands are very encouraging; he hopes that in another month Cebu will be free from locusts.

Bohol is doing good work, but the efforts of the Governor of Leyte deserve the greatest credit. A recent conference with Governor José M. Veloso revealed the fact that but two municipalities in this province are at present infested by "loctones" or hoppers. Instead of having the people work in mass as is customary with the pit method, he is requiring a certain quantity of loctones each day from each male adult in the province. This method has been carried on since December last, and has resulted in a nearly complete eradication of the pest in that province. Of the funds (₱5,500) alloted to Leyte, to date only ₱500 has been expended; the balance is still in the treasury of that province. The iron (400 sheets) shipped to that province is, all but 70 sheets, still available at the capital. The expenses of the campaign carried on in Leyte have been practically nothing as compared with those in the other provinces. Governor J. M. Veloso, says, "There is no need of heavy expenditures if the proper provincial officials go about the work in the right way. The requiring of every person to bring a certain amount of



Calthrops (*Trapa bispinosa*).

loctones to the municipal officers does not impose a hardship on the people in general and will soon eradicate the pest."

Reports from Occidental Negros show that the heaviest infestation is in the northern districts, the southern region being well under control.

NOTES BY P. J. WESTER, Horticulturist.

THE LEMON INDUSTRY IN ITALY.

Italy ranks first among the lemon-producing countries, and the tree grows there from Lombardy and Venetia in the north to Calabria and Sicily in the south. Sicily is the great center of the Italian lemon industry, seven-eighths of the 8 million lemon trees growing in Italy being planted in Sicily, or about fifteen times a greater number than is planted in California.

The "Agricultural News," which supplies the above information, also states that the average yield of a lemon tree in Sicily is 800 to 1,200 fruits; sometimes a tree will yield 2,000 fruits per year; also that the lemon crop of Sicily and Calabria was 6,900 million lemons, or 20 million boxes, each box containing from 300 to 360 fruits.

In Sicily lemons are planted from the coast up to an altitude of 435 meters. The trees are planted from 3.6 to 5.4 meters apart in the orchards. No frost protection is necessary in Sicily—although in Sorrento, on the coast of the gulf of Amalfi, the trees must be protected from the frost during the winter. The best lemons are produced on the rich soils in the hills. On the lighter soils the fruit ripens earlier but is poorer in quality.

The culls are utilized in making essential oil. In this operation the fruit is cut into halves, the pulp is removed, and the empty skins are soaked in water for four to five hours before the expression of the oil. Forty-five one-hundredths of a kilogram of oil is obtained from 1,600 to 2,200 half skins according to the quality and the ripeness of the fruit, green fruits yielding somewhat more oil than mature ones.

The production of lime and lemon juice in Sicily in 1911 was estimated at 4,800 tons, as compared with 6,300 tons in 1910, and 7,500 tons in 1909. This calculation is based upon the estimate that 162 liters of concentrated lemon juice is equivalent to 100 kilograms of citrate. It is stated that the world's annual average production of citrate of lime and concentrated juice is 7,200 tons, of which about five-sixths is produced in Sicily. The remainder is produced in the British West Indies, Mexico, and Central and South America.

THE SAPUCAIA NUT.

From time to time as the more or less unexplored parts of the Tropics and their products become better known, new sources of subsistence and industrial raw materials are disclosed. One of the "newest" nuts is the "Sapucaia" (*Lecythis zabucajo*), a large tree, native of Brazil, Guiana, and Venezuela, and related to the Brazil nut. Like the Brazil nuts, the Sapucaias are many in a fruit, contained in a large "shell." The Sapucaia is said to be more easily digested than the Brazil nut, however, and to be of better flavor, sweet, and partaking somewhat of the flavor of the almond. In South America an oil is expressed from the Sapucaia nut that is used as a food and also manufactured into soap. The Sapucaia is sometimes seen in the United States where it is known as the Paradise nut.

THE SUGAR INDUSTRY IN FORMOSA.

The Consular and Trade Reports contain an interesting article on the sugar industry in Formosa. The Japanese methods of reconstruction of the government and the rehabilitation of the industries in Formosa have been subjected to considerable criticism, but there can be little but praise for the results attained.

The first modern sugar mill was erected in Formosa in 1902 by Americans; to-day there are thirty-three up-to-date factories in operation with a crushing capacity of 24,000 tons of cane per day, capitalized at 83½ million pesos and with a paid up capital of ₱42,173,358.

For modern equipment the Formosan mills are unexcelled, and it is contended that the American-made mills are more complete and more economically arranged than those made in other countries.

The present high standing of the sugar industry in Formosa has been attained by governmental organization and coöperation through its creation of the sugar bureau. From a total of 48,671 tons of sugar in 1900, the production had risen in 1910 to 300,676 tons. With improved methods of culture the yield during the same period had increased from 11⅓ to 16 tons per acre.[1]

Most of the sugar is exported and refined in the country of its destination, Japan importing the bulk of the raw sugar. Only one refinery has so far been erected in Formosa—in Tainan, owned by the Ensuiko sugar company. The Taihoku Sugar

[1] One acre equals 0.4 hectare.

Company has recently filed application for the erection of a refinery in Taihoku, the capital of Formosa, and other companies may be expected to follow suit in the near future.

In connection with the above notes it may be of interest to know that in 1910 the average yield of sugar per acre was 4.4 tons in Hawaii, 4.3 tons in Java, 1.8 tons in Cuba, and 1.6 tons in Formosa. The cost of sugar manufacture per pound[1] in these countries was ₱0.0544 in Hawaii, ₱0.0322 in Java, ₱0.041 in Cuba, and ₱0.0342 in Formosa.

THE FRUIT EXPORTS OF PORTO RICO.

In the December, 1912, issue of the REVIEW mention was made of the progress of Porto Rico agriculturally. In this connection the following statistics culled from the Cuba Review should prove interesting to the fruit growers in the Philippines.

Exports to United States.

	1911	1912
Pomelos	₱619. 396	₱1, 049, 952
Oranges	1, 407, 992	1, 168, 736
Lemons	4, 644	6, 262
Limes	3, 924	1, 920
Pineapples	1, 281, 426	1, 367, 602
Canned pineapples	299, 488	317. 342

How long will it be before the Philippines can make a similar showing in her fruit exports?

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

A NEW CATCH CROP.

There is considerable excitement in India and Ceylon over a new indigo and a new method of handling that crop. Of course, synthetic indigo nearly ruined the natural-indigo trade several years ago but with this much better yielding variety (*Indigofera arrecta*) from Java, and a much improved method of handling the raw product, invented by Baron Schrottky, there is excellent reason to believe that natural indigo will come back into favor and probably turn the tables on the synthetic article.

The new variety is said to produce green material at the rate of 50 tons per hectare per year. This crop will undoubtedly be grown on most of the rubber estates in Ceylon and the Malay States and is recommended as a catch or subsidiary crop for coconut plantations here in the Philippines. Not only is the

[1] One pound equals 0.45 kilograms.

plant an almost ideal soil-renovating crop, being of the legume family, but the profit from the green material itself when turned into indigo paste should be, according to recent estimates, as high as ₱500 per hectare—which is, of course, better even than the average coconut crop itself.

A NEW PLOW.

Orchardists and horticulturists in general have long been looking for a special plow adapted to small fields, orchards and plantations, where the heavy traction or cable plows are not serviceable. It now appears that there is an English patent out for a motor-propelled plow which will probably revolutionize many agrarian practices. This new motor plow is fitted with a 4-horsepower engine and cuts a furrow at the rate of about 5 kilometers per hour. The cost of fuel is a negligible quantity, being only some ₱1.50 per day—which of course leaves horse-plowing away behind. The plow itself weighs only a little over 300 kilos. A cultivator may be attached to the plow so that it can be used in orchards and small fields to excellent advantage.

A very interesting feature of the plow is that it is more or less automatic. Like some of the larger power plows it has a self-guiding apparatus so that after the first furrow is made the plow need only be started and it will automatically cut the next furrow. Theoretically then, if the field was a large circular one the farmer could make the first furrow on the motor, then get off and leave the plow to *finish the field itself.*

SILK INDUSTRY IN MADAGASCAR.

There seems to be a general revival of silk culture throughout the Tropics. Recently the Madagascar government has taken steps to encourage mulberry growing in that Island and the classification of cocoons is to be made a matter of government regulation. The writer has personal knowledge of the excellence of the silk fabrics made by the Madagascar natives. Some very fine specimens of "Malagasy" silks are obtainable in most of the East African ports. This silk seems to be the product of a local caterpillar, probably native to the Island.

CAVIAR.

Now that the United States is producing a very considerable part of the false caviar of the world (from some of the larger fish in the Mississippi River and from the salmon canneries of

the Pacific Coast), it is of interest to note that the true caviar of the Caspian district of Russia is threatened with a considerable decrease. It seems that there is a great deal of poaching and illegitimate handling of the sturgeon roe. This not only results in decreasing the number of mature fish but demoralizes the trade itself. The poaching is carried on according to the American consul at Odessa by "English" hooks. These are sunk deeply into the mud where the fish lie when not in condition for spawning and their capture under these conditions is, of course, highly reprehensible.

Two other fish, the Beluga and Severuga, beside the sturgeon, produce commercial caviar. The value of the caviar yield is now about 10 million pesos per annum. More than half of this vast amount is exported to Germany while nearly 150 tons, or about one-third, are exported from Astrakhan to the United States.

SUNFLOWER POTASH.

The south of Russia is noted as the great sunflower district of the world but only recently have the stalks, usually considered a useless by-product, been made to produce potash. The ashes of these stalks are rich in potassium salts and some 7,000 tons of this potash fertilizer are annually exported from the north Caucasus district. When we realize what an almost infinitesimal part of the weight of the plant is its ashes, we are forced to regard the sunflower crop of that district as something more than remarkable.

BRAZILIAN RUBBER.

The horrible revelations of abuses in the Amazon River forests have had several good effects already. One of these is the recent regulations decreed by the Brazilian Minister of Agriculture regarding the establishment of experimental farms in the rubber forest districts. Not only are agricultural colonies to be started around these experiment stations, but hospitals will be erected for the welfare of the laborers as well as the colonists and rubber-syndicate staffs themselves. There will also be food-producing "factories" and exhibitions of food crops and products.

A NEW STOCK FEED.

All the world has been watching Germany for the past half decade to see what will be the next great discovery in regard to the potato crop. That country has already done more for this

crop in an economico-technical way than probably all other countries combined. It has given the world cheap potato alcohol and several kinds of potato flour, and has possibly improved somewhat on the American methods for extracting potato starch. The latest innovation is cited by the *Frankfurter Zeitung* as a stock feed made by artificially drying potato tops. These are said to have about the same value as meadow hay and it is claimed that there are no harmful results to the domestic animals.

On account of the succulent nature of the tops special apparatus is, of course, necessary—and that is just where Germany, of course, excels. If this new scheme works out, it is expected that about one-fourth of the total crop can be dried for stock feed and this will mean some quarter of a million tons, worth at least 100 million pesos. The Philippine coconut planter must take cognizance of this since any article which affects the demand for poonac in Europe must, of course, affect the value of the Philippine coconut plantation.

BOOK REVIEW.

"THE FLORA OF MANILA."

By O. W. BARRETT, *Chief, Division of Horticulture.*

To the individual interested in either the botany or horticulture of the environs of Manila, this excellent work, by E. D. Merrill, Botanist, Bureau of Science, meets the demand completely, accurately, and interestingly. There have been several well-meant attempts toward helping plant lovers to a better knowledge of ornamentals and economics as well as the best methods of getting the most good out of them here, but it was reserved for Mr. Merrill to really put down in black and white the whole *flora* side of the subject.

Not only does the work carry some 450 pages of botanical descriptions, but there is also an excellent key to the families so that an amateur can readily trace out the relationship and even the genus and species of all of the ordinary and most of the rare ornamentals to be found in any of the Manila gardens. Over 1,000 species of 591 genera and 136 families are described as occurring wild or cultivated in the 100 square kilometers included in the area in question; this is only about one-sixth of the total number of plant species in the Philippines, but it is far more than most people realize; in fact, it is a question whether any other city in the world could give so good a showing. There is also a glossary of all technical terms which might puzzle a beginner.

The only criticism which we might make regarding the appearance of the work is its lack of illustrations. It would hardly be possible, however, to draw the line at any moderate number of illustrations in such a work as this; there would be as much need, perhaps, for 300 illustrations as there would be for 30. Mr. Merrill has added a popular treatise on the plant and its parts for those who are not fully familiar with botanical anatomy and, not satisfied with this, he has given a chapter on the herbarium and the best methods of cheaply and easily making one. The nomenclature is standardized and while

some of the most radical of the modern taxonomists might take issue with the author as to the "code legitimacy" of some of the names which are still under question, the names given in this work are absolutely reliable. Even the author of each species has been punctiliously given, and synonyms, where necessary, are inserted.

In a word, this work (which may be obtained from the business manager of the *Philippine Journal of Science,* Manila, P. I., at ₱5 per copy) is indispensable to everyone who wishes to really know the plants of Manila.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

DECEMBER, 1912.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		S. Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.1	------	26.7	------	26.2	------	25.7	------	24.1	------	27.2	------
2	25.6	------	26.8	------	25.8	------	27	------	24.9	------	26.3	------
3	25.3	------	26.8	------	26.1	------	25.9	------	24.3	9.9	26	------
4	25.1	------	27.1	------	25.8	------	26.4	------	24.7	8.3	26.2	------
5	26.6	------	27.3	------	26.6	------	26.1	------	24	5.9	26	------
6	25.7	------	27.6	1	26.5	------	27.2	------	24.6	------	26.1	------
7	25.4	------	27.6	1	25.5	5.8	25.4	------	24.2	3.5	23.8	------
8	24.5	1	27.1	4.3	25.4	------	23.7	------	22.6	9.3	23.6	------
9	25.1	137.5	26.3	20.3	24.6	8.3	23.8	------	24.2	22.4	24	------
10	24.2	47.1	25.8	58.1	24.5	5.8	22.8?	------	23.3	------	24.4	------
11	26.1	2.7	27	3	25.7	------	24	------	23.4	3.3	24	------
12	26.3	10.2	27.6	8.1	26.5	------	26	------	23.9	3.4	25.2	------
13	25.8	16.5	26.5	18.7	26.5	2.3	25.4	------	23.4	------	------	------
14	26	4.6	27.2	14.4	26.6	------	26.1	------	24.2	------	------	------
15	27.4	------	27.9	------	26.4	------	26.1	------	24.8	------	25.4	------
16	26.5	.3	27.5	1.3	26.2	------	25.7	------	24.2	6.4	25.6	------
17	26.2	4.6	27.3	2.8	26.4	------	25.4	------	24.1	------	25.9	------
18	25.7	------	27.1	------	25.7	------	25.3	------	24.6	------	25.2	------
19	25.1	------	27.6	2.5	25	------	24.4	------	24.3	3	24.6	------
20	25.9	------	28.4	3.3	26.1	1	25.6	------	24 9	------	24.3	------
21	26.5	2	27.5	16	26.3	4.6	25.8	------	25.1	.5	24.8	------
22	25.2	26.2	27.9	9.4	26	------	25.6	------	23.6	------	23.8	------
23	23.9	38.6	27.3	12.1	26	------	25.2	------	23.7	3.6	24.4	------
24	24.2	53.6	27.5	15.2	26.4	5.8	25.3	------	23.9	16.6	23.6	------
25	25	138.8	27	3.8	26.4	------	26.6	------	22.3	20.4	25.8	------
26	26.5	2.6	27.4	7.1	26.5	------	23.8?	8.7	22.6	134.1	26	1.3
27	26	22.4	27.2	3.3	26.6	------	25.5	------	23.4	20.6	25.6	------
28	25.5	32.7	27	10.7	27	------	27	------	23.8	2.3	25.6	------
29	25.5	6.1	27	------	26.6	------	27	------	22.4	7.8	25.7	------
30	26.1	10.2	27.9	4.5	26.2	------	28	------	22.8	4	26.2	------
31	25.7	17.9	27.3	5.1	26.7	------	26	------	24.4	24.9	25.9	------

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Vacant.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Assistant Horticulturist, H. H. BOYLE.

Entomologist, C. R. JONES.
Assistant Entomologist, D. B. MACKIE.

AGRICULTURAL INSPECTORS.

H. R. REED.
W. A. MACE.
F. P. NICKLES.
E. S. HASKELL.
H. O. JACOBSON.
I. C. ROOT.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	F. C. KINGMAN, Superintendent.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	E. F. SOUTHWICK, Acting Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	Vacant.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

SUPERVISING VETERINARIANS.

Charles G. Thomson.
Stanton Youngberg.
Charles H. Leavitt.

VETERINARIANS.

J. B. Bell.
W. R. L. Best.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. A. Curtis.[1]
W. L. Davis.
Charles H. Decker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.[1]
A. H. Julien.
Harry F. Kern.
William A. Kliphardt.
Walter A. Korb.
A. M. Meade.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.

[1] On leave.

Six-year-old abacá plants, Libuton variety, Daliao, Davao.

FIBER NUMBER

THE PHILIPPINE

Agricultural Review

VOL. VI APRIL, 1913 No. 4

CONTENTS.

117537

ILLUSTRATIONS.

EDITORIAL.

THE PHILIPPINE FIBER INDUSTRY.

By the ASSISTANT TO THE DIRECTOR.

The Philippine fiber industry includes the production and preparation of a very large number of vegetable fibers. It is an industry that is carried on to a greater or less extent in every municipality and practically every barrio of the Islands. The fibers of the Philippines include our most important export product, other minor exports, and a great variety of materials that enter into the domestic economy of the people.

Abacá (Manila hemp), the most important fiber in the Philippine Islands, has for many years ranked first in our list of exports. For a number of years this one product comprised approximately two-thirds of the total export trade of the Islands. The increasing production of copra and sugar has reduced in some measure the relative importance of abacá, although this fiber still remains our leading export. With the new uses for abacá that are now being developed, and with the gradual improvement in the quality of this fiber that will be the natural result of better methods of cultivation and fiber extraction, there should be a steady increase both in the quantity and the value of our abacá exports.

The present condition of the abacá industry is not satisfactory. The Philippine planters, having had a monopoly in the production of this fiber, have failed to introduce improved methods either in working their plantations or in the preparation of the fiber for market. The results that must inevitably follow such practices are now in evidence. Many of the largest abacá plantations are in badly run-down condition and large quantities of inferior fiber are being produced.

There is, however, a very encouraging feature of the abacá situation, this feature being the present attitude of the planters. They are coming to realize the needs of the situation, and there is a strong demand for assistance in the work of introducing improvements. This demand will be met in the immediate future by the establishment of a coöperative demonstration station in the heart of the abacá-producing district of southern Luzon. Other stations will be started as rapidly as the necessary arrangements can be made. These demonstration stations serve as

headquarters for the demonstration of improved methods, and from the stations trained inspectors are sent out to assist and instruct the planters on their own farms.

The Philippine fiber second to abacá in commercial importance is maguey. Our maguey industry has suffered during the past few years from prevailing low prices, but is in a greatly improved condition at the present writing. The one most vital feature of this industry is the question of introducing modern fiber-cleaning machines. Such machines have been perfected and are available, but their profitable operation requires a larger supply of raw material than the individual Philippine maguey planter is in a position to supply. The situation is similar to that of the small sugar planters, where the establishment of "centrals" calls for coöperative effort. We have in the Philippine Islands large areas that are better suited for the cultivation of maguey than any other crop, and it is greatly to be desired that this industry be placed on a substantial basis by the introduction of the necessary fiber-cleaning machines.

Another fiber of increasing importance in these Islands is kapok, sometimes called "tree cotton." This fiber is coming into very general use as a material for filling cushions, mattresses, and other articles. The demand for kapok already exceeds the supply, prices are high, and this fiber has a most promising future. We find kapok trees scattered throughout the length and breadth of the Philippine Archipelago, and conditions are entirely suitable for their more general planting. A large part of the kapok now produced is wasted, but as the value of this product becomes better known it will be more generally utilized, and kapok trees will probably be planted to a considerable extent as a secondary crop.

There are many other local fibers that are largely used by the people of the Islands, and that are of some importance in our interisland trade. The development and improvement of abacá, maguey, and kapok should, however, receive first attention. Each of these industries has its own special features, but the general problem is the same for all. This problem is to definitely ascertain such improvements as it may be practicable for the Philippine farmer to introduce, and then to transmit this information to the farmers in such a way that it will be utilized.

The present number of the REVIEW covers in considerable detail the work of the fiber division of the Bureau of Agriculture and the present condition of the fiber industry. In a subsequent number the question of improving this industry by means of coöperative demonstration work will be considered.

BUREAU OF AGRICULTURE CIRCULAR No. 21—KAPOK CULTURE.

[Circular No. 21. Manila, February 25, 1913.]

KAPOK CULTURE.

By M. M. SALEEBY, *Chief, Fiber Division.*

INTRODUCTION.

The kapok tree is so widely distributed throughout the Philippine Islands that there is hardly an island or province where it can not be seen growing here and there in gardens, along the borders of fields, or along the sides of public highways. The floss, or fiber, produced in the pods is the principal product of the tree, and for centuries it has been used by the Filipinos for filling pillows, cushions, mattresses, and other similar articles. It is estimated that there are produced in the Philippines several hundred tons of floss of which a comparatively small part is used for domestic purposes, and practically the whole of the remainder is left unutilized. It is only since 1905 that an attempt has been made to export the floss from the Philippines and, even since then, the quantity exported is entirely too small in proportion to the amount produced.

It is believed that the present steady demand for kapok and its high price will render possible the collection and marketing of a large part, if not practically the whole, of the Philippine crop, at a reasonable profit to the producer. It has also been demonstrated in Java that the cultivation of kapok on a large scale for commercial purposes will give satisfactory results, considering the simplicity and the comparatively low expense of its cultivation. Furthermore, it appears that the admirable qualities of the floss for filling purposes have recently been fully recognized by the markets of the world, with the result that a strong demand for it has been created, which the supply so far has not been able to meet.

To acquaint the producers of kapok in the Philippines with the full merits of the floss and the importance of its production on a large scale for export, and to guide those whose interest in it

has already been awakened, is therefore the aim of this circular. For further information on the subject the reader is referred to Bureau of Agriculture Bulletin No. 26, entitled "The Kapok Industry."

CLIMATE.

The climatic conditions which directly affect the growth of the kapok tree and the development of its pods are three, namely, the degree of temperature, the amount of rainfall, and the frequency of strong winds.

The kapok tree requires a warm climate. For this reason its successful cultivation can only be accomplished in tropical and semitropical countries. For the same reason kapok should not be cultivated at an elevation above 500 meters, though it has been known to grow at as high an altitude as 1,200 to 1,500 meters.

Kapok does not require a large amount; nor an even distribution, of rainfall. It can withstand a comparatively long period of drought, and in fact this is essential during the period from the first appearance of the flowers until the pods have been harvested, which here in the Philippines usually covers the five months between February and June.

The long, heavy, and horizontal branches of the kapok tree may be seriously injured by strong winds. During typhoons it is not uncommon to see trees actually uprooted and others badly mutilated. This should emphasize the necessity of selecting locations outside the typhoon belt; if within it, they should be protected by windbreaks, either natural or otherwise.

SEED SELECTION.

The great majority of the kapok trees in the Philippines are propagated from cuttings. In the few that are propagated from seed there is not even the slightest regard for the selection of good seed from desirable trees. This accounts for the present lack of uniformity in the size, number, and development of the pods produced by the trees in general.

Seed for planting should be selected from kapok trees which are more than five years old, which are of rapid growth and of early and uniform fruiting habits, and which produce a large number of pods having a comparatively thin husk and containing a large quantity of floss of good quality. After selecting the tree or trees with due consideration to the above requisites, it will again be necessary to select only the desirable pods from each, since many pods will be found which are either too small, in-

completely developed, or which contain fuzzy floss of a natural dull color and seed far below the average size.

Plate III shows the wide variation in the size of pods which may occur in trees grown in the same locality and under the same conditions. Similar variation also occurs in the quantity and quality of the floss, and in the size and development of the seed; hence the importance of seed selection.

CULTIVATION.

After having indicated the importance of the requisite climatic conditions and of seed selection, the next points which should claim the attention of prospective kapok planters are the details of cultivation. This involves a knowledge of the following important matters: requirements as to soil, methods of propagation, planting and subsequent operation, and cultural methods.

Soil.—The kapok tree flourishes in a wider range of soils than most other tropical plants of economic importance. Volcanic loams and soils of alluvial formation are best adapted for kapok, for they afford a soft medium for the proper development of the root system, besides being generally well drained. In sandy loams, and in clay loams also, the kapok tree produces very satisfactory results, providing these loams are sufficiently deep and well drained. Soils of inferior fertility are generally considered unsuitable for planting kapok on a large scale, though fair crops are known to have been obtained in several instances.

Propagation.—Kapok is propagated from cuttings or from seed. The use of cuttings is by far the easier method and is, therefore, more commonly practised. Cuttings are usually obtained in various sizes ranging from one-half to 2 meters or more in length. The small cuttings should not be of the same season's growth, and they should be planted as soon after they are cut as possible. They should be planted from 30 to 50 centimeters deep, according to size, and preferably at the beginning of the wet season.

Propagation from seed is on the whole the better method. The seed is of rapid germination and the trees reproduced from seed are generally healthier, more productive, and more resistant to strong winds and attacks from white ants and other insect pests than those reproduced from cuttings. The seed should be planted at the beginning of the wet season in a nursery in hills about 15 centimeters apart. The nursery should be properly prepared and kept clean from weeds all the time. As soon as the seed germinates a shade should be constructed over the young

seedlings and this should not be removed until they have attained a height of 12 to 15 centimeters, which usually takes about twenty to twenty-five days from germination. At this stage the hills should be thinned leaving in each only the one plant which exhibits the best and most rapid growth. The seedlings are ready to be transplanted into the permanent field at the age of 10 or 12 months, or when they have attained a height of 80 centimeters or more. Sometimes the seedlings are left in the nursery until they are 18 to 24 months old but there is probably no advantage in this practice, as the larger the seedlings, the more difficult it usually becomes to transplant them without a high percentage of loss.

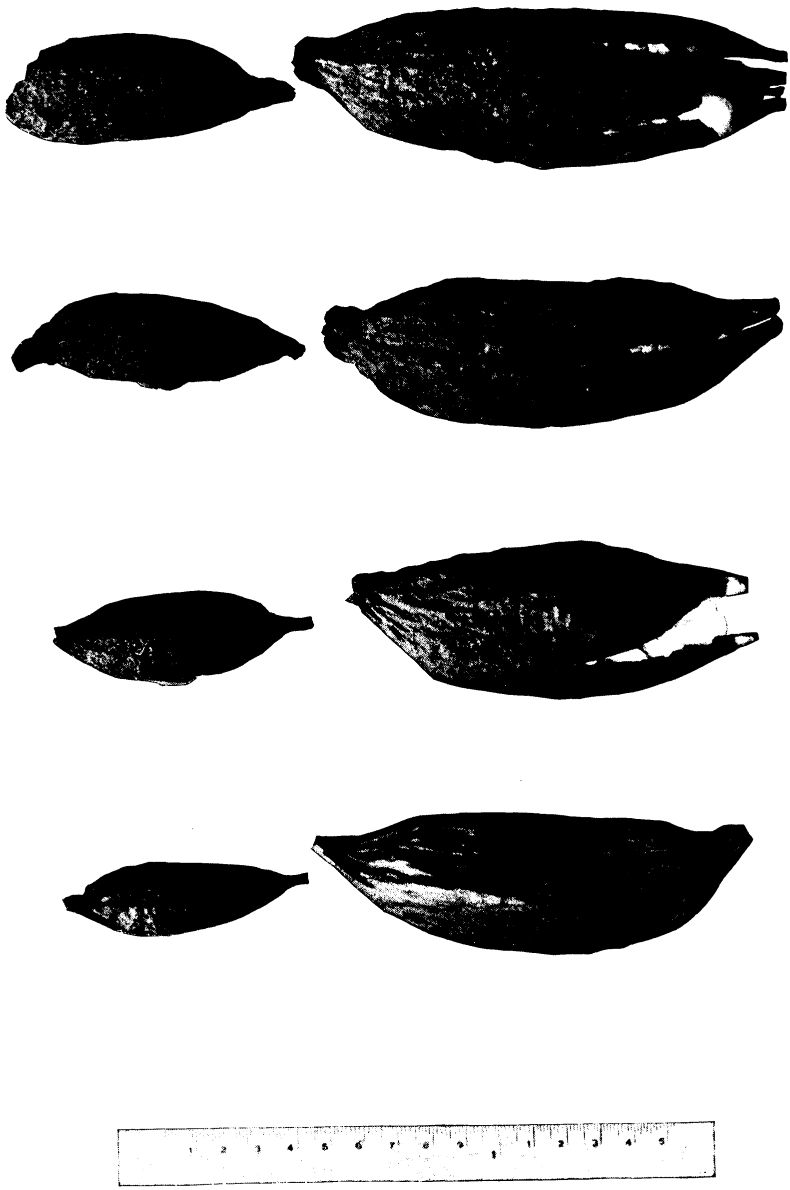
Planting.—As in the case of cuttings, the seedlings also should be planted out early in the rainy season. The precautions which are usually taken in transplanting seedlings of other trees and plants must be observed here. The roots must not be unnecessarily mutilated, and sufficient soil should be left on them. The holes should be dug large and deep enough so as to leave at least 15 centimeters of fine soil under and around the roots. Before transplanting it is essential to cut off all the leaves; and if the seedlings are more than 50 centimeters but less than 1½ meters high the stem should be cut back to the former height. If they are more than 1½ meters, then they should be cut back to about 1 meter from the ground. The soil immediately around the young plants should be kept loose and clean from weeds, especially during the first six or eight months.

If kapok is intended to be the only or principal crop, the trees should be planted in straight rows not less than 6 or 6½ meters apart, with the same distance between the trees in the row. At a distance of 4 or 4½ meters, which we often hear recommended, the branches of two adjacent trees overlap, and during strong winds they are usually badly mutilated and often die back about one-half to 1 meter. At a distance of 6 to 6½ meters there will be about 280 to 240 trees to the hectare, respectively.

No plowing or periodical cultivation of the soil is required with kapok, unless some other secondary crop which requires such operations is raised between the rows. In so far as the kapok alone is concerned, it will be necessary to keep the soil in good condition only immediately around the plants. In the remaining spaces it is best, of course, to keep down all weeds, especially the indigenous ones with woody stems. As this operation in most cases entails too high an expense in proportion to the value of the kapok crop, it might best be accomplished

Five-year-old Kapok trees at the Lamao Experiment Station.

PLATE III.



Kapok pods, showing wide variation in development.

A cluster of fully developed but unripe kapok pods.

by the planting of cover crops, preferably legumes of economic value, which will help to cover all, or a large part, of the cost of the upkeep of the plantation. The decided advantages accruing to other economic plants and trees from the use of leguminous cover crops are, of course, equally shared by the kapok tree.

Cultural methods.—The prevalent method of growing kapok trees in scattered localities and without any order or system can only be justified in those instances in which the product is required merely for domestic use. In Java this has been gradually giving way to the more popular method of growing kapok as a secondary crop with coffee, cacao, vanilla, pepper, maguey (cantala), sisal, and others. As a secondary crop, kapok appears to have given such unprecedented results that several attempts have recently been made to cultivate it as the main crop with such secondary crops as corn, peanuts, mongo, or some other similar annual crop. By both the above methods kapok will give satisfactory results, the choice of either one depending mostly on the nature of the soil.

As a rule, kapok should not be cultivated as a main crop on rich soils, as in these soils other more remunerative crops, such as abacá (Manila hemp), sugar, coconuts, cacao, etc., can be raised. If, however, on account of lack of either capital or labor, or both, the cultivation of any of the above principal crops can not be accomplished, the cultivation of kapok is then justified. In such instances, of course, a secondary crop in the form of corn, peanuts, mongo, beans, etc., will materially increase the revenue derived from the use of such land. By the cultivation of kapok on rich lands as a secondary crop with another of the above as the main crop, however, the best results are obtained.

In soils of medium fertility kapok can be raised as a secondary crop with coconuts, maguey, or sisal, or as a main crop with corn or with a leguminous crop of economic value.

HARVESTING.

The first crop is usually harvested from the trees between the third and fourth year when reproduced from seed, and a year or more earlier when reproduced from cuttings. The first two or three crops are of course small, the normal crops beginning from the sixth or seventh year on, and keep increasing from year to year until the limit is reached at the age of 30 or more years.

The harvest usually begins toward the middle or latter part of April and lasts until the beginning or end of July. If possible, the harvest should be completed before July, for then the rains, which cause considerable damage to the floss, are usually abundant and more frequent.

To know when the pods are sufficiently ripe is perhaps the first and most important step in harvesting. Before ripening, the pods have a light-green color and a smooth surface (Plate IV). As soon as they ripen they turn light brown and the surface becomes somewhat wrinkled (Plate III). At this stage the pods should be harvested, for if left longer they always open at the top and the floss becomes exposed to rain and dust or other impurities which impair its quality. The pods should also be harvested during dry weather so as to prevent fermentation while they are stored prior to the separation of the floss.

After it has been gathered, the fruit should be sorted and then opened as soon afterwards as practicable. The sorting is necessary as some pods will be found bruised or otherwise damaged, while others will be found to show signs of incomplete or premature development. The longer the floss remains in the pod the more it depreciates in color and luster, and therefore storing should not last longer than is absolutely necessary. If during harvesting, or soon after, the pods become unavoidably exposed to rain or moisture, or if it becomes necessary to harvest them before they are sufficiently dried on the trees, then they should be opened immediately and spread on a clean floor, instead of being stored. Care must be taken, however, that such floss be not mixed with that from the dry and ripe pods.

CLEANING THE FLOSS.

Hand methods.—The bulk of the kapok produced is still being prepared by hand apparatus, which are simple in construction and crude in operation. The simplest of these, which is the first improvement over the handpicking method, consists of a bamboo frame set over a box or over the floor and so constructed as to have square holes large enough for the seeds to fall through. The floss and seed are put on the frame and beaten by bamboo forks or sticks until all the seeds have dropped through the holes, when the clean floss is removed and the operation repeated with another lot.

In the most recent hand method, which is probably an improvement over the preceding one, the floss as it comes out of

the pods is put in a bamboo basket or in a hollow cylinder with a perforated base. Through this is put a stick or piston to the lower end of which are nailed two pieces of wood forming a cross. The top of the basket or cylinder is covered, and by connecting the top of the piston with the necessary wheels and a handle the piston is made to revolve inside the cylinder or basket. The cross at the end of the piston stirs the kapok and the seed is separated and falls through the perforation at the base.

These crude native apparatus can only be used to advantage where labor is cheap and where kapok is produced on a comparatively small scale. In the production of kapok on a large scale, the use of modern and more economic machinery is indispensable.

Machines.—The invention and use of kapok-cleaning machines is one of the most vital factors affecting the present and the future development of the kapok industry. Without the use of such machines the cultivation of kapok will not be taken up by the more progressive class, but will be restricted to the poorer class of producers, as has been the case. Without machines, also, the industry can not develop to the extent warranted by the superior qualities of the floss and its suitability for numerous important uses.

The machines thus far constructed perform their functions on very much the same principles, as all or most of them have been based on the more improved hand process of cleaning the floss. These machines are, as a rule, simple both in construction and operation, strong, cheap, and portable, thus affording an opportunity for all classes of kapok producers to use them to advantage, providing sufficient trees are grown in close proximity to render their use practicable. For further information regarding kapok machinery the reader is referred to Bureau of Agriculture Bulletin No. 26, entitled "The Kapok Industry."

YIELD.

From several observations made by different persons in different localities it appears that an estimate of the annual yield of clean kapok from a tree of normal growth and under 7 years of age may be placed at 350 to 400 pods. Trees between 7 and 10 years should yield an average of 600 pods or more.

A very wide divergence is also encountered in the yield of floss by pods. While in some cases about 150 pods will yield

1 kilo of clean kapok, in others it may take as many as 300 to yield the same quantity. In this respect it is probably safe to calculate on 230 pods to produce 1 kilo. The judicious selection of seed for planting will undoubtedly increase the average yield of floss in the pods.

On the above basis a hectare planted in kapok, and containing 280 trees from 5 to 7 years of age, ought to bear 95,000 to 100,000 pods, which, at the rate of 230 pods to the kilo, will yield 410 to 480 kilos of clean kapok per year. From the seventh to the tenth year, a hectare should yield about 640 kilos.

In a general way it may be said that the yield of seed is double that of the floss. That is, a tree which generally yields 3 kilos of clean kapok during the year, yields also about 6 kilos of seed. Various tests have shown that the weight of clean kapok varies from 55 to 65 per cent of the weight of the seed. The yield of seed is also variable both as regards the number and the size of the individual seeds.

VALUE.

During the decade from 1900 to 1910, the value of kapok advanced from 27 centavos per kilo in 1900 to about 80 centavos in 1907 for the highest grade. After the latter year the value declined to 64 centavos in 1909, but advanced again to 80 centavos in 1911. In 1912 the value continued to advance reaching its maximum of 90 centavos toward the latter part of the year. With the exception of the years 1908, 1909, and 1910, the rise in value has been gradual. This gradual rise in the value of kapok is accounted for by the continual increase in the uses made of it, which was in turn caused by a more general knowledge of its superior qualities and its suitability for several purposes heretofore unknown. The recent awakening of a general interest in the cultivation and production of kapok in many of the tropical countries where it was practically unknown is directly caused by this rise in its value. This has also made possible the systematic cultivation of the tree and the cleaning and marketing of its product by the use of proper and modern methods.

USES.

The principal use of the greater part of the kapok produced, however, is for filling pillows, cushions, mattresses, and other similar articles of upholstery. Next to this may be mentioned its comparatively recent use for filling buoyant cushions. Finally may be cited its most recent use for textile purposes.

For upholstery purposes kapok is preferred to all other filling fibers on account of its great capacity for filling and also its great elasticity. The latter is demonstrated by the fact that all cushions and mattresses that are filled with kapok will, after the pressure is taken away, resume their previous dimensions. In other words, kapok does not get matted with use, as is the case with all the other filling materials. Its great capacity for filling is shown by the fact that the weight of the quantity of kapok required to fill a certain mattress is considerably less than that of any other material used for the same purpose.

The use of kapok in buoyant cushions dates back to a very recent period, prior to which cork was almost exclusively used. Now the former is gradually replacing the latter, and it is only a matter of a few years when kapok will be used to a greater extent than cork for this purpose. This recent use made of kapok has increased the demand therefor and manufacturers of articles of upholstery have already begun to complain of the excessive price of the raw material.

About the use of kapok for textile purposes very little is as yet known beyond the fact that a certain process has been evolved by Professor Goldberg of Chemnitz, Germany, which is based entirely on a novel and somewhat complicated system of preliminary preparation and spinning. The floss is treated in such a way as to render it easily spinnable, notwithstanding its shortness and brittleness which until now have been considered unsurmountable obstacles. Just how much of a success this can be called, and to what particular textile use kapok yarn is adapted, can not at present be stated.

BY-PRODUCTS.

The most valuable product of the kapok tree is, of course, its floss. Next to this in value and importance is the seed, which has also become an article of trade.

In Europe, to which the seed is now shipped in large quantities from Java, and in smaller quantities from other countries, including the Philippines, the oil is used to a large extent in the manufacture of soap and as an adulterant with other oils; the residue, or cake, is probably largely used as cattle feed and as fertilizer.

The weight of the seed is, roughly speaking, double that of the floss, and its value in the Manila market at the present time is about 3½ centavos per kilo. On this basis a hectare of

land planted to kapok under 7 years of age will yield 800 to 900 kilos of seed [1] per year valued at ₱28 to ₱31.50. The wood of the kapok tree, which is light and soft, is used for tanning leather and for other minor purposes. The tree yields a dark-red, almost opaque, gum which has some medicinal value. The young leaves, when ground into a paste, are also used medicinally. The bark contains a reddish fiber which is sometimes used for tying purposes.

---

[1] See page 164.

THE RENOVATION OF THE ABACÁ (MANILA HEMP) INDUSTRY.

By M. M. SALEEBY, *Chief, Fiber Division.*

In value and importance the abacá crop of the Philippine Islands is second only to rice. Its importance does not consist only in the millions of pesos that are annually sent here from the United States and Europe to purchase the fiber, but also in its value and usefulness for local manufactures and for the various important domestic uses for which it is employed. The present status of the abacá industry has recently been sufficiently dwelt upon in this REVIEW and in other publications of this Bureau, and it is an indisputable fact that the industry is in great need of renovation and reëstablishment on a more sound basis. This need has always existed, but it has recently been more strikingly presented to the attention of all parties interested in the welfare of the industry, as a result of the calamities which have recently come upon these Islands in the form of a prolonged drought and severe typhoons, which have emphasized the necessity of reform in certain phases of the industry.

The most important phases of the abacá industry upon the reform of which should be entirely based any attempt toward renovating it are the following: (1) The judicious selection of suitable sites for the plantations; (2) the practice of modern methods of culture; (3) the improvement of the quality of the fiber; and (4) the adjustment of the relations between the local buyers and the producers.

In the space here available, it is difficult to do justice to the above important problems, since each requires for its thorough discussion as much space as is here allowed for them collectively. However, if the writer succeeds in indicating the chief causes that have brought the industry down to its present condition and is able to suggest effective and practicable remedies for the same, he will have accomplished his earnest desire.

SELECTION OF SUITABLE SITES.

With abacá as with any other crop, the success will depend in a large measure on the suitability of the location of the plantation for that particular crop, both in regard to its soil and its climatic conditions. The soil and climatic requisites for the successful cultivation of the abacá plant are fully described in Farmers' Bulletin No. 12 (revised edition), and also in certain numbers of this REVIEW,[1] to which the reader is referred. At present it is sufficient to state that the soil should be of a high degree of fertility; the climatic conditions required are an even distribution of rainfall, with a high degree of precipitation; and the site should be free or protected from destructive winds. A large number of planters do not exercise sufficient judgment in selecting suitable sites for their plantations. In some of the principal abacá provinces it is often the custom to plant abacá or coconuts on the land which is not suitable for growing rice. In many instances, of course, the sites selected are wholly unsuitable for abacá. This lack of judgment attains its worst stage during the periods when the prices of the fiber are high. As long as high prices last, reasonable profits can be obtained even though the plants do not attain the extent of growth which they should attain. During dull periods, however, or even when conditions are normal, very little, if any, profits can be obtained from such plantings, and consequently the reputation of abacá is prejudiced in several ways: First, owing to the small size of the stalks on such land, the fiber is unusually short and the yield very low; second, the owners of such plantings are rarely in a position to market their product to the highest bidder, but they are, generally speaking, at the mercy of certain local buyers and must take what is offered for their fiber. This, as we shall see later, has been one of the chief causes for the production of inferior grades.

Summing up the situation from this point of view, it will be observed that the selection of unsuitable locations for abacá plantings has had a very undesirable influence on the industry in general, by causing an unhealthy increase in production which has afforded an opportunity for other fibers to compete somewhat seriously with abacá. By an unhealthy increase in production is meant that which is caused by an excessive proportion of low grade fiber and from which little or no profit is derived by the producer. At the time of the present writing the prices of

[1] Vol. IV, Nos. 6 and 12; Vol. V, No. 13.

Eight-months-old abacá plant at La Carlota Experiment Station. Cowpeas planted as a cover crop.

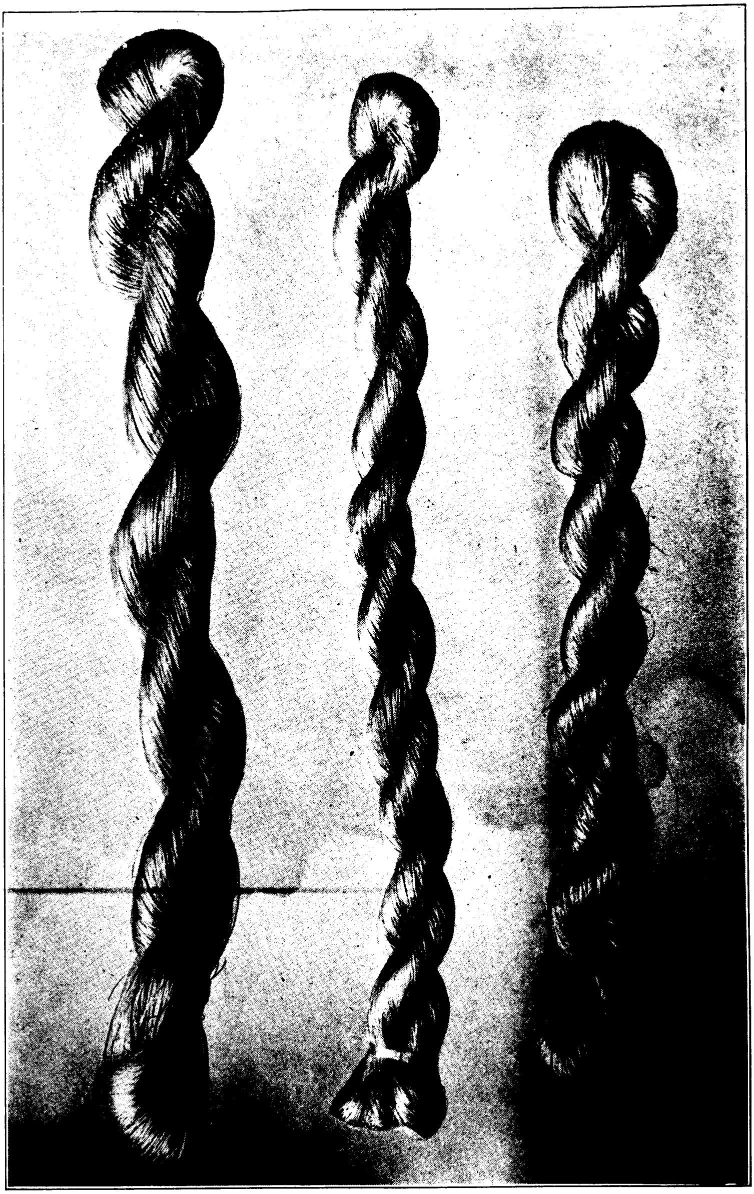
Field of old abacá.

(*a*) Extracting abacá (Manila hemp). First Process—inserting knife prior to separating the outer fibrous strip.

(*b*) Extracting abacá (Manila hemp). First process—actual separation of the outer fibrous strip.

PLATE VIII.

Stripping abacá (Manila hemp).



Hanks of knotted abacá (Manila hemp).

abacá are abnormally high, and substantial profits are obtained from almost any kind of planting, although there is no assurance that these conditions will continue for a long period. It is hoped, therefore, that the abacá planters will learn from past experience and, as soon as prices are again normal, all the plantations which do not continue to yield reasonable profits or which can not be sufficiently improved by thorough cultivation will be planted to some other crop for which the soil and other conditions are more suitable than for abacá. Instances of this kind are numerous in almost every abacá-producing province, especially in the provinces of southern Luzon and in Leyte, where, if the practice here recommended is followed, it will afford a very strong impetus to the industry in general. Not only the owners of such lands profit by the change of crops, but also the rest of the abacá producers, as such a change will help to keep the market steady by reducing the large quantities of inferior fiber with which it is being flooded and in the production of which no one profits except, perhaps, the buyers.

CULTURAL METHODS.

Next to the elimination of the plantations that are unsuitable for the profitable production of abacá, the problem that should claim our attention is the reason why many plantations, which apparently meet with all the requisites for the successful cultivation of abacá, do not give more satisfactory results. This problem finds its solution in the inefficiency of the cultural methods which the majority of producers now practise.

Crude and antiquated methods have no place in modern agriculture. They had their day during the times when each country held a monopoly in one or more crops and did not have to face competition from outside either in the production of that particular crop or in that of substitutes therefor. That day is now over, and while in the production of abacá the Philippines practically still have a monopoly, other fibers which are used for many purposes for which abacá is used have already influenced the latter in more than one respect, and threaten a keener competition in the near future. In the face of such competition, therefore, the abacá producer can now hardly afford to remain passive and keep that secure attitude which he has so long enjoyed. He must discard the old and crude methods and adopt instead a better and more efficient system. It is only by this means that he may now and in the future hope to enjoy

the prosperity which his ancestors enjoyed and which he has recently been in danger of losing.

The most important cultural methods in which reform must be instituted before the desired progress can be attained are the following: Planting, cultivation, and the renewal of old plantations, which, on account of the important part they play in the renovation of the abacá industry, are hereby discussed separately.

1. PLANTING.

The two principal features that characterize the present prevalent method of planting are too close planting and lack of systematic planting. As a result of too close planting, the hills usually intermingle before they are 6 or 7 years old, due to the natural tendency of the abacá plants to spread out as they grow; and furthermore, planting at random prevents the practice of proper methods of cultivation, which are required during all stages of growth. It is not necessary to discuss here at length the details of the important steps of preparing the soil and planting, all of which have been covered in the several publications on the subject issued by this Bureau. The abacá planter should remember, however, that the plants should be set out in straight rows, not closer than $2\frac{3}{4}$ to 3 meters each way. Unless this is done, subsequent cultivation by proper and improved methods will be impossible.

2. CULTIVATION.

Cultivation in its widest significance comprises all operations connected with planting and the bestowing of attention, care, and labor upon the plants with a view of obtaining the maximum returns from them. Working the soil and weeding out all objectionable growth are, however, two of the principal operations that are included under cultivation, and these will form our chief topic of discussion at this point. The weeding out of objectionable growth can of course be effected by the planting of cover crops or by the use of cultivators or other tools, such as the hoe, bolo (cutlass), etc.

Ordinarily, it is almost impossible to use plows or cultivators either preliminary to planting abacá or during the first three years of its growth, on account of the large number of trees felled in clearing which cross the field in all directions. During this period, therefore, whatever cultivation is given the plants must be done by hoes or bolos, or in the form of cover crops

which usually remain until the abacá plants have completely shaded the ground.

Camote (*Ipomoea batatas*) is generally planted as a cover crop with young abacá. This serves the purpose in so far as it covers the soil and yields a useful food product, but it has been demonstrated that camote retards to a considerable extent the growth of the young plants. Leguminous crops, such as velvet beans, peanuts, cowpeas, etc., especially those of economic value, should be preferred to camote, for they grow quite as fast, cover the soil quite as completely, and, besides, enrich the soil with the much-desired element of nitrogen.

After the third year, when the plants will have become old enough for stripping, the question of cultivation resolves itself into regular and thorough weeding, with periodical working of the soil. The common method of weeding by bolos is neither economical nor efficient enough to justify its use. Even the use of the bolo is very sparingly practised by the majority of the growers, with the result that the abacá plantations in most instances have more the appearance of a semiforest growth. There is probably no crop of equal importance anywhere in the civilized world, which is as badly neglected as abacá is in the Philippine Islands.

With abacá the best results are obtained only by regular weeding, preferably by means of hoes, and the periodical use of modern cultivators. The advantages of the latter will be particularly shown during prolonged spells of dry weather, similar to the one that occurred last year. During last year's drought several reports were made by progressive planters to the effect that, had it not been for the use of cultivators, the damage would have been three or four times as serious. It may be of interest to mention here that most of these plantations have now resumed their normal condition of production, while the others, which were practically neglected during the same drought, will not recover completely until the end of this year or the beginning of the next, if indeed some of them ever recover at all. Last year's drought has also emphasized the necessity of irrigating abacá. Wherever possible, irrigation canals should be dug and provision made for periodical irrigation, whenever required.

3. RENEWAL OF OLD PLANTATIONS.

It is no exaggeration to state that not less than 75 per cent of the abacá plantations in Albay, Camarines, Sorsogon, Leyte, Samar, and other provinces where the cultivation of abacá has

been carried on for years, are too old, and the land and the plants are practically exhausted. This accounts for the very low yield from such plantations, which, on an average, hardly exceeds 400 kilos of fiber per hectare; a plantation of normal age and growth should yield on an average of 1,000 kilos per hectare. It is obvious, therefore, that the question of the renewal of old plantations and the knowledge of the methods used are, or should be, of paramount importance to the abacá planter.

The life of the abacá plant varies from twelve to twenty or more years, depending on the suitability and fertility of the soil and on the amount of care and cultivation given to the plant. Heavy soils, lack of cultivation, overcutting of stalks, and the frequent digging up of rootstocks or suckers all tend to shorten the life of the abacá plant. The majority of producers realize these facts, but by the methods now used in renewing old plantations they do not obtain the desired results. Their method consists merely in digging up shoots from the old plants and setting them out in the intermediate spaces. The plants thus reproduced are obviously neither so healthy nor so productive as the original ones.

The method that should be substituted for the above may be briefly described as follows: The old plants should be dug up, the soil plowed to a depth of 20 to 25 centimeters, and then a crop of beans, mongo, peanuts, or some other economic leguminous crop raised on it. After such a crop is harvested, what remains of it should be plowed under, and soon afterwards the abacá rootstocks or shoots should be planted in straight rows and at proper distances. As soon as the abacá plants have appeared above ground, a leguminous cover crop should be planted between the rows in order to keep the soil free from weeds until the plants have shaded the ground. Subsequent operations of cultivation should be restricted to the use of cultivators and hoes, which are far more effective and much less expensive than the use of the bolo. Thus, in the course of a few years, a new plantation with vigorous plants will stand on the site of the old one.

IMPROVEMENT OF THE QUALITY OF THE FIBER.

The abacá stalk is made up of overlapping leaf sheaths which are in reality prolongations of the petioles of the leaves. It is not, therefore, a stalk in the true sense of the word, though it is commonly referred to as such. This peculiar formation of the abacá stalk is responsible for the existence of five or six distinct

grades of the fiber, for the reason that the sheaths, from the outside ones to those near the core, differ perceptibly in thickness and color as well as in size and softness of the fiber contained therein. After every four or five sheaths we invariably find a noticeable change in the quality of the fiber. The distinct grades which are the natural outcome of the formation of the stalk may be designated as follows: Low, current, good current, good, and best, conforming to the five sets of distinct sheaths. These grades are obtained when machinery is used to extract the fiber, and also by the ordinary hand apparatus, providing it is so adjusted as to operate evenly and uniformly. Instead of these five grades, however, there now exist five groups each including three or more grades. This unfortunate increase in the number of abacá grades is due principally to the faulty method of extracting the fiber and the lack of care in handling it prior to and after extraction.

To show the extent to which the quality of abacá fiber can be improved, it would be necessary to give the relative quantity of each grade or group of grades when the fiber is carefully and uniformly extracted, and compare that with the same relative quantity when the fiber is prepared and placed on the market in the ordinary way. The several tests made at various times by the fiber office of the Bureau of Agriculture have demonstrated that the fiber carefully extracted from a certain number of stalks and graded in a uniform manner averaged approximately as follows:

Low grades[1]	per cent	5
Current grades[2]	do	10
Good current grades[3]	do	25
Good grades[4]	do	35
Best grades[5]	do	25

The above are average results of tests made with nine varieties of the abacá plant. No part of the fiber, with the exception of a few sheaths from one or two varieties, ever graded below superior seconds, and no unnecessary waste of fiber was caused. This last was proved by the percentage of fiber obtained from the green stalks, which ranged from 2.6 in the best varieties to 1.5 in the poorest ones, or an average percentage of 1.8.

[1] From fair brown (red) to superior seconds inclusive.
[2] From current to midway inclusive.
[3] From 75 per cent over current to 25 per cent over good current.
[4] From 50 per cent to 150 per cent over good current.
[5] From 150 per cent to 300 per cent over good current.

It is difficult to estimate the present production of abacá by grades, and the proportion of the exports of each grade to the total. Droughts, typhoons, market conditions, and, to some extent, established custom of the producers in a certain province or district, all tend to cause a considerable variation in the relative proportion of the grades produced. The last is explained by the rather large differences in the quality of the fiber produced in the different provinces. It is roughly estimated that the Albay crop averages between good and superior seconds; the Camarines crop, fair or good seconds; the Sorsogon crop, about 25 per cent over current; the Leyte crop, current U. S.; the Samar crop, midway, or 75 per cent over current; the northern Mindanao crop, about current or 25 per cent over; and the southeastern Mindanao crop, good current or 50 per cent over.

The exports of abacá from the Philippine Islands are not tabulated according to grades and, therefore, the exact figures showing the proportion of the exports of each grade to the total are not available. A few of the principal exporting houses, however, keep a record of their exports for each grade, and it was through the courtesy of these firms that it has been possible to give the following approximate estimate of the exports of abacá by grades for the calendar years 1909 to 1912, inclusive:

Exports of abacá by grades (approximate) 1909–1912.

	1909		1910		1911		1912	
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.
Best and good marks	2,623	1.65	2,625	1.50	9,875	6.25	6,020	[a] 3.50
25 per cent over good current	21,147	13.30	7,087	4.05	5,609	3.55	5,160	3.00
Good current	9,381	5.90	9,188	5.25	9,954	6.30	10,148	5.90
75 per cent over current	13,118	8.25	10,937	6.25	12,008	7.60	14,620	8.50
Midway	12,879	8.10	17,412	9.95	15,010	9.50	18,232	10.60
25 per cent over current	24,327	15.30	32,200	18.40	19,750	12.50	21,500	12.50
Current	24,327	15.30	40,865	23.35	30,810	19.50	29,240	17.00
Superior seconds	16,695	10.50	15,137	8.65	16,590	10.50	29,584	17.20
Good seconds	13,674	8.60	15,837	9.05	17,064	10.80	15,480	9.00
Fair seconds	9,063	5.70	11,025	6.30	8,690	5.50	11,868	6.90
Good brown	5,724	3.60	6,650	3.80	6,478	4.10	3,440	2.00
Fair brown	3,339	2.10	4,200	2.40	3,634	2.30	4,816	2.80
Pacol, strings, etc	2,703	1.70	1,837	1.05	2,528	1.60	1,892	1.10
Totals	159,000	100	175,000	100	158,000	100	172,000	100

[a] Considering that the larger portion of the high-grade fiber has recently been largely handled by special firms other than the regular exporting houses, for export to Japan, Italy, France, Switzerland, and other European countries, where the fiber is used chiefly in the manufacture of hatbraids, certain kinds of laces, etc., the proportion of such fiber to the total can more correctly be estimated for 1912 at 10 instead of 3.5 per cent.

The average proportions of the exports of each of the principal groups of grades to the total exports for the last calendar year is, therefore, approximately as follows:

Best and good grades	per cent....	10
Good current grades	do........	18
Current grades	do........	40
Low grades	do........	32

A comparison of the above results with those given before clearly indicates the extent to which the quality of abacá may be improved by the practice of a more judicious method of extraction and by careful handling. It must be admitted, however, that for many reasons such progress is very difficult of accomplishment, though a considerable advance can, and should, be made. It should also be borne in mind that an improvement of the quality of the fiber must inevitably be accompanied by a decrease in production, due to an increase in the quantity of waste fiber when the higher grades are prepared in preference to the lower ones. The extent of the decrease in production will naturally depend on the grade prepared, and also on the skill of the men, the adjustment of the apparatus, and the variety and the degree of ripeness of the stalks.

Before proceeding to state how such an improvement can be brought about, and the extent to which it would be feasible to encourage it, it will be interesting to give a brief review of the principal uses for which the different grades of abacá are employed in the world's markets, as this bears directly on the problem in question.

The highest group, commonly known as "best marks," or "superior good current," consists of three grades, namely, 300, 250, and 200 per cent over good current. During the last three years, particularly last year, these grades have been in great demand by the cordage manufacturers, owing chiefly to the heavy purchases made by the Japanese and European manufacturers of hats and hat braids. The Japanese have been and are still buying chiefly the fiber, or raw material; while Italy, Switzerland, and France buy the fiber in knotted hanks or braids, manufactured locally, chiefly in the first-mentioned form. The rapid development of this recent hat-braid industry has reduced considerably the supply of the highest grades in the London and American fiber markets and has consequently stimulated a strong demand for them.

The next group, commonly known as "good marks," and also included in the term "superior current," consists of three grades, namely, 150, 100, and 50 per cent over good current. The fiber in this and the preceding group is far superior to all other cordage fibers, not only in strength but also in color and luster. It is mostly due to these grades that abacá has been given undisputed rank as the premier cordage fiber of commerce. The grades in this group are largely used for the manufacture of the higher grades of Manila rope, the lowest grade alone being sometimes used for making a special grade of binder twine. Generally speaking, the grades forming this and the preceding group meet with no competition from other sources, and the demand for them is almost always firm.

The third, or good current, group is here intended to include the three grades—25 per cent over good current, good current, and 75 per cent over current. These, it is understood, are generally used for making the good grades of Manila rope and also for the high grades of binder twine, but mostly for the former purpose. In these grades also abacá remains practically free from competition from other fibers, because of the decided superiority of its qualities to those of the other fibers used for the same purposes. The demand for these grades is also, on the whole, firm.

The fourth group, or current grades, includes midway, 25 per cent over current, and current. These are also mostly used for cordage purposes, though a much higher percentage of them than of the preceding groups is used for binder twine. The fiber in these grades is superior in strength to henequen, sisal, hemp, and the other cordage and binder-twine fibers, but in color it is inferior to these latter. It is in these grades that abacá begins to meet with competition, and the demand for it and its prices begin to be influenced to an appreciable extent by the other fibers. The competition is perhaps not so apparent in the midway grade, but it unquestionably is so in the current. The market quotations on the best grades of henequen and sisal are governed somewhat by that of current abacá, and are, as a rule, equal to the latter.

The lower grades of abacá include all those below current U. S. viz., current U. K., superior seconds, good seconds, fair seconds, good brown, and fair brown. These are principally used for the manufacture of the lower grades of cordage and the ordinary grades of binder twine, probably mostly for the latter use. The demand for these is governed to a considerable

extent by that for henequen, sisal, hemp, etc., most of which are decidedly superior to the former in either color or softness, or both.

Thus the grades making up the first, second, third, and part of the fourth groups have practically exclusive uses in which none of the rest of the cordage and binder-twine fibers can compete to any serious extent, except perhaps to a small extent as an adulterant with the lowest grade of the third group and the two highest grades of the fourth. This should indicate the necessity of producing on a larger scale the grades of the first three groups. The production of the lower grades at the expense of these would seem to be not only prejudicial to the interests of the producers, but also detrimental to the welfare of the industry in general. For it must be borne in mind that the cost of production of henequen and sisal, the two principal competitors of abacá below the grade of midway, is considerably less than the latter, owing to the use of machinery in their preparation and to their simple and inexpensive cultivation. Henequen and sisal, though they are not so strong as the lower grades of abacá, yet possess other characteristics, such as color and fineness, in which they are preferable to the latter, hence their recent use for many purposes for which the lower grades of abacá were formerly exclusively used.

There is undoubtedly a limit to the demand for abacá, which the production should not exceed. This limit varies somewhat every year, depending on the condition of the other fiber crops and on the general demand for binder twine and cordage. It is estimated that during normal years about 130,000 to 140,000 tons of abacá are needed by the world's fiber markets. This quantity is apportioned among the five groups of grades in proportions which the writer has never been able to ascertain, though, of course, this proportion is bound to be variable in response to the varying demands of the markets. Hence it is not possible at the present time to fix the extent to which the quality of abacá should be improved. That a considerable improvement over the present quality is urgently required, there is no doubt. Such an improvement will benefit not only the merchants but also the producers.

During 1912, the exports of abacá amounted to about 172,000 tons, of which about 10 per cent (17,200 tons) were of the two highest groups; about 18 per cent (or 31,000 tons), of the third, or good current, group; 40 per cent (or 68,800 tons), of the fourth, or current, group; and about 32 per cent (or

55,000 tons), of the fifth, or lower-grade, group. From market reports and correspondence with fiber manufacturers and local exporters, it is learned that the supply of good current and the higher grades was considerably below the demand for them. This was due partly to the insufficient production of these grades and partly to the rapid development of the abacá hat-braid industry which has taken away the larger portion of the highest grades. During this year (1913) the indications are that the demand for the high grades will exceed that of last year, while the total production of abacá is estimated to be about 135,000 tons, or 25 per cent less than last year. There is, however, a possibility of a larger decrease in production, but it is believed that the continuance of the prevalent high prices will increase the area harvested, especially in those provinces which were not seriously affected by last year's drought and typhoon, in which case the production will be as estimated above, if not a little higher.

In view of existing conditions it would seem safe to encourage the production of abacá of a higher average grade, until the entire production shall average in the third, or good current, group. In other words, the writer believes that during 1913 the best interests of the producers and a compliance with the requirements of the market will be obtained by the production of fiber which will average approximately as follows: 15 per cent, or 18,500 tons, of the first group; 15 per cent, or 18,500 tons, of the second group; 30 per cent, or 38,000 tons, of the third group; 30 per cent, or 38,000 tons, of the fourth group; and 10 per cent, or 12,000 tons, of the fifth group, out of an estimated total of 125,000 tons. This would be more than a half-way improvement toward the more or less theoretical standard given before, and would at the end of the year give a clearer conception as to what the future course of the producers should be. If at the end of the year the increase in the supply of higher grades has resulted in an increase in their consumption for the uses for which they are at present employed or for new uses, and the demand for them remains strong, then a further improvement can be recommended for future years. It is believed, however, that the production of the high grades at the above-mentioned rate will not lower the demand for them to any serious extent, and the producers can be assured of making higher profits in producing them than they are at present realizing on the lower grades. An examination of the local as well as the London and American market quotations on abacá during

the last few years, especially the latter part of last year, will leave no doubt as to the correctness of the above statement.

How can such an improvement in the quality of abacá be brought about? It is a well-known fact that the recent development and success of the henequen, sisal, and other fiber industries was brought about principally by the invention and general use of suitable machinery for extracting the fiber. There is, therefore, no question but that if similar machinery suitable for extracting abacá fiber becomes available, the industry in general will be improved, for such machinery not only raise the average grade of the fiber but will also bring about the much-desired uniformity in grade, by cutting out the several grades and shades of grades, the existence of which is entirely due to the unsystematic and antiquated method now in general use. Several attempts have been, and are still being, made, to invent suitable machines, but so far without any great degree of success. Until such machines are available, we must look somewhere else for the solution of the above problem.

ADJUSTMENT OF RELATIONS BETWEEN BUYERS AND PRODUCERS.

The writer believes that the strippers in the majority of the abacá provinces understand perfectly how to turn out the higher grades, and they can be made to do so providing sufficient inducement is given them. This fact resolves the solution of this problem to two factors: First, the adjustment of the relation between the local buyers, or middlemen, and the producers; and, second, the proper handling and just treatment of the laboring class, or strippers, by the producers or planters. Unless these relations are adjusted in a satisfactory manner it will be difficult to arrive at a satisfactory and permanent solution of this problem.

We do not have to go far to prove the validity of the above statements, for in the comparatively few localities where there is a progressive and independent class of producers the quality of the fiber produced is considerably higher than the average, the laborers are paid higher wages, the producers are more prosperous, and the industry in general is in a much more flourishing condition than in the localities where the producers are economically dependent on the local buyers. Generally speaking, the buyers do not sufficiently discriminate in prices between the high-grade and the low-grade fiber, and the producers are forced to accept the prices offered them by the former.

This state of affairs naturally leads the producers and the laborers to turn out the inferior grades, which is practically the only resort they have to protect their interests. This also explains the origin of the oft-quoted assertion to the effect that the producers realize higher profits in preparing the lower grades instead of the higher ones. The action of the producers under such circumstances as exist at present all over the abacá-producing provinces is easier to understand than that of the middlemen. Why the local buyers obstinately refuse to discriminate sufficiently in prices paid for the different grades is a question that is not so easy to answer. Perhaps one of the most characteristic examples of the conduct of middlemen is found in Albay Province, where it is reported on good authority that often there exists a difference of 5 to 6 pesos per 100 kilos between the price of a certain grade at Legaspi and at some of the towns in the same province. This difference is said to be even greater in the higher grades. All this will serve to show that the attitude of such middlemen must be actuated by one or more of the following reasons:

1. Most of the middlemen, being at the same time merchants, prefer to keep the poorer class of producers economically dependent upon them. This they are able to do by discouraging any attempt on the part of the latter to produce higher grades and realize larger profits.

2. In many cases the buyers do not themselves understand the differences between the various grades of fiber, and they feel safer in buying the lowest grades in which the differences are more apparent in quality and less so in price, than between the higher grades.

3. In many instances the local buyers calculate their profits at a certain amount per 100 kilos, as a result of a contract or some agreement with some other buyer. In such cases, it is obviously to the advantage of the buyers to purchase a low-grade fiber, for with a certain sum of money they can purchase more low-grade than high-grade fiber, and thus realize larger profits.

Thus not only the agricultural phase of the industry is in sore need of reform, but also the business phase of it. Indeed much of the success that it is hoped may be obtained in the reform of the agricultural methods now in vogue will to a large extent depend on the extent of the reform that can be effected in the adjustment and improvement of the relations between the buyers and producers. Hence this paper will be incomplete if it does not refer to the steps that must be taken to bring

about this latter reform. To describe in this paper the remedies for the present lamentable state of affairs with any detail is out of the question. The writer must therefore content himself with the following suggestions which will be intended to give an impetus in the right direction to any reform movement:

1. It will be necessary to enlighten the uneducated class of producers in regard to the principal grades of the fiber and the differences between them both in quality and price. In order to do so, it will be necessary, first, to establish standard grades which shall have uniform designation and which shall not be subject to change or modification; and, second, to classify such standard grades in groups, say, of three grades each such as is given in this paper, for the purpose of enabling the producer to determine for himself the group in which his product comes. This does not necessarily mean a reduction in the number of grades, but it does require a fixed and uniform standard. It may also be necessary to distribute samples of the grades throughout the principal abacá provinces, so as to have at least one complete set in every town of importance, and keep these sets in tight cases, renewing them at regular intervals, say once or twice a year.

2. The institution of planters' coöperative associations, which has recently been carried on in many countries to great advantage, could and should be carried out in the Philippines also. It is understood that such associations are established in Mexico for the purpose of regulating the supply of fiber in the market, as well as for maintaining a certain standard of quality. It is also learned that the various associations are represented by one central committee which not only arranges with certain banks to advance the producers a certain percentage of the value of their product until such time as the latter see fit to sell, but also studies the condition of the world's markets and keeps the producers advised as to the proper course they should follow. Such a system appears to have given excellent results in Mexico, and it is believed that some such system here in the Philippines would give similar results.

3. An educational campaign, accompanied by practical field demonstrations, similar to that organized by this Bureau in the Provinces of Cebu and Iloilo, would, it is strongly believed, give gratifying results. This Bureau is at the present time perfecting plans for such a campaign, and it is hoped that within a short time work will be started. The planters can, by taking sufficient interest in such work, derive a great benefit, especially

in matters pertaining to the most efficient methods of cultivation and preparation of the fiber, which they will not derive in any other way.

The proper application and carrying out of the above-mentioned remedies is perhaps one of the most serious economic problems that at present confront the Filipino people. Its satisfactory solution will call for a thorough investigation and understanding of present conditions as well as for coöperation on the part of all parties directly interested in the welfare of the abacá industry. That the institution of such a reform is difficult of accomplishment and that it will have to be worked out gradually no one doubts; but since it must be accomplished sooner or later, there is no time more appropriate for beginning than the present.

MAGUEY (CANTALA) AND SISAL IN THE PHILIPPINES.

By M. M. SALEEBY, *Chief, Fiber Division.*

INTRODUCTORY STATEMENT.

The maguey plant (*Agave cantala* Rox.) bears a close resemblance to the true sisal plant (*A. sisalana* Per.) and the henequen plant (*A. fourcroydes* Lem.). The products of these plants also, though differing somewhat in color and fineness, are similar and can be used practically for the same purposes, especially when they are prepared by the same methods. Until a comparatively short time ago nearly the entire supply of the so-called sisal fiber of commerce was produced by the Mexican species—henequen. During the last decade, however, the superior qualities of the products of the true sisal and the maguey plants have become more generally known to the commercial world, resulting, especially in the case of the former, in a somewhat rapid development of these two industries. Such a development, however, took place only in those countries where modern methods were used in the cultivation of the plants and in the preparation of their fiber. Thus we hear of the successful raising and production of sisal in East Africa, the Bahamas, and Hawaii, and of maguey and sisal in Java, in all of which countries the industry is carried on along the same lines as with henequen in Mexico.

The maguey plant is very widely distributed throughout the Philippine Archipelago, where it has been grown for many years and where it appears to flourish and attain its maximum growth and development. The production of maguey fiber in the Philippines for commercial purposes did not begin until the year 1904. Since 1906 the industry has remained practically stationary with no material improvement in the methods of cultivation and fiber extraction and with no increase in the area cultivated nor in the amount of fiber produced. The following statistics will serve to illustrate the difference in the development, since

1904, of the sisal industry of German East Africa and the maguey industry of the Philippines:

Year.	Sisal exports (German East Africa).	Maguey exports (Philippines).
	Metric tons.	*Metric tons.*
1904	765	690
1905	1,397	1,911
1906	1,854	2,443
1907	2,830	2,681
1908	3,897	1,887
1909	5,284	4,066
1910	6,971	2,606
1911	[a] 8,500	4,270
1912	(b)	6,767

[a] Approximate.

[b] The official figures have not yet been received, but it is believed that the exports exceed 10,000 tons.

The increase in the exports of maguey from the Philippines from 4,270 tons in 1911 to 6,767 tons in 1912 was due chiefly to the considerable advance in the price of the fiber since July, 1912.[1] As soon as the price becomes normal again, the exports will undoubtedly fall to between 3,000 and 4,000 tons. The exports of sisal from German East Africa, however, show a gradual and considerable increase since 1904, irrespective of the many turns that the fiber market has taken during these years. The history of the henequen industry of Mexico also shows a development identical with that of the sisal industry of German East Africa, the exports of henequen having increased from 81,000 tons in 1900 to over 120,000 tons in 1911.

To explain the reasons why the maguey industry of the Philippines has not developed at the same rate as that of sisal and henequen, and to show the means by which such a development can be attained, is therefore the aim of this paper.

HENEQUEN, SISAL, AND MAGUEY.

Before proceeding further with our subject, it will be necessary, as well as interesting, to give a brief description of the henequen, sisal, and maguey plants in order to show their relative merits as regards their respective habits of growth and the quality of their fibers.

Henequen.—This species produces a fiber of the same name, which is largely used in making binder twine. The plant lives fifteen to twenty-five years from the time of planting, and when

[1] This increase is also partly due to the failure of some of the other staple crops, as a result of the prolonged drought and typhoons during the same year.

PLATE X.

Sisal (*Agave sisalana* Per.) plants at La Carlota Experiment Station.

Harvesting henequen (*Agave fourcroydes* Lem.).

PLATE XII.

Cleaning maguey (cantala) by "retting."

PLATE XIII.

Harvesting maguey (*Agave cantala* Rox).

full grown it has a trunk one-half to 1½ meters in height. It is cultivated on a commercial scale practically exclusively in Mexico, particularly in the state of Yucatan. It requires for its development a hot dry climate and a well-drained limestone soil. The leaves bear lateral spines, are straight and rigid, and glaucous in color. The fiber is 1 to 1½ meters long, of a light reddish-yellow color, and rather coarse. It is known in the commercial world as "sisal," "Mexican sisal," or "Yucatan sisal." These names were given to the fiber before the true sisal was known to commerce. The fiber is cleaned entirely by machinery.

Sisal.—This plant is native to Mexico and Central America and was introduced into the Bahamas about the middle of the nineteenth century. From there it was later introduced into Hawaii, and was brought from this place to the Philippines about seven years ago by the Bureau of Agriculture. It is grown in Java and East Africa also, where it was recently introduced, probably from the Bahamas.

Sisal endures variation of soil and climate better than henequen, but its best development is obtained in well-drained limestone soils. It lives eight, ten, or more years, unless it is neglected, when its life is considerably shortened. The first harvest can be gathered four to five years from planting. The leaves are green or light green in color, rigid, and characterized by the total or partial absence of the lateral spines. The fiber is whiter, finer, and possibly stronger than henequen, and, when cleaned by machinery, commands a price somewhat higher than the latter. When cleaned by the retting method, in which the leaves are soaked in water for a period of five to nine days to soften the pulp, its market value is less than that of henequen. It is designated by the word "sisal" used after the name of the country in which it is produced, such as "East African sisal," "Hawaiian sisal," "Bahama sisal," etc.

Maguey (*cantala*).—This plant is cultivated in the Philippines, Java, and British India, to which places it was brought from Mexico. It lives from nine to twelve or more years, providing it is properly and periodically cultivated and harvested. The first crop can be obtained in three or four years when the plants are reproduced from suckers, and a year later when from bulbils. Like the sisal plant, it does not develop a real trunk. The leaves are of a grayish-green color, are longer and less rigid than either the sisal or henequen leaves, and, like the latter, bear lateral spines. The fiber when cleaned by machinery is finer, whiter, and probably more flexible than either the sisal or henequen and

commands a higher price. Its quality and commercial value with relation to the other two fibers is reversed when it is cleaned by the retting method. The Philippine product is known by the names "Manila maguey," "Manila aloe," and "Philippine maguey;" the Java product, by the names "Java sisal," "cantala," etc.; and the Indian product by "Indian sisal" and "Bombay aloe."

The above description of the plants and their fibers makes clear the following points: First, the henequen, sisal, and maguey plants are very similar in their general outward appearance, and in their habits of growth; second, they require for their best development similar soil and climatic conditions; third, their cultivation and the extraction of their fiber can be effected by exactly the same methods and means; and, fourth, the maguey fiber is equal, if not superior, to sisal and henequen.

MAGUEY IN THE PHILIPPINES.

The manner in which the maguey industry in all its phases has been, and is still being managed in the Philippines, leaves a great deal to be desired. The plantations are, as a rule, too small and too far apart, thus rendering the use of fiber-extracting machinery impracticable. Ever since the decline in the price of fibers in 1908 and 1909, the planters in the chief maguey provinces, such as Ilocos Sur, Ilocos Norte, La Union, and Cebu, have kept up the cultivation of maguey mainly as an emergency crop. Thus when typhoons, droughts, or locusts cause a shortage in the production of rice, corn, or some other of their staple crops, they turn their attention to maguey and endeavor to clean enough fiber to tide them over until the other crops again come in. During such years, however, there is an increased production of maguey.[1] This custom has unfortunately led to the practice of the ruinous method of overharvesting the plants, by which many plantations have been ruined.

The maguey fiber is prepared by retting the leaves in salt water in order to soften the pulp and facilitate cleaning the fiber by hand. This method is not only tedious and discouraging to any attempt to extend the cultivation of the plant, but it also injures the fiber to a considerable extent by destroying several qualities which determine its usefulness and value. It is due to this method of fiber extraction that the value of Philippine ma-

[1] This explains in part the rather variable production of maguey in the Philippines. See statistics on page 184.

guey is lower and the demand for it less than for sisal and henequen.

Summing up the situation as it exists in the Philippines, it would seem that maguey is generally raised as an emergency crop, and as such it will be difficult, if not practically impossible, to encourage its cultivation on a larger scale and by the use of modern and systematic methods.

A review of the history of the development of the henequen and sisal industries in the countries where they are now firmly established will show that these industries remained in a dormant state, similar to the present condition of the maguey industry here, so long as the crude and antiquated methods of planting and fiber extraction were in use. The present flourishing condition of the henequen industry in Yucatan and the sisal industry in the Bahamas, East Africa, and Hawaii, was brought about not only by the existence in the above countries of suitable natural conditions, but also by the adoption by the planters there of proper cultural methods, and by the use of machinery for extracting the fiber.

The maguey fiber, as mentioned before, is equal, if not superior, to sisal and henequen. Natural conditions in certain provinces in the Philippines are entirely favorable for the growth of the maguey plant and the proper development of its fiber. Therefore, what is required here to establish this industry on a firm basis and afford it every opportunity to develop is to discard the crude and antiquated methods now in use and to substitute for them the more improved methods of the principal sisal and henequen-producing countries. Such a substitution will bring under cultivation to maguey immense tracts of land in certain provinces, which, on account of their unsuitability for raising any of the principal Philippine crops, have been lying idle for years. Such a substitution will also bring about the much-desired improvement in the quality of the maguey fiber, and will enable it to compete favorably with both sisal and henequen in the fiber markets of the world. With an improvement along the lines suggested in this article, the maguey industry will develop to such an extent as to entitle it to a place among the leading agricultural industries of these Islands.

SISAL IN THE PHILIPPINES.

The history of the introduction of sisal into the Philippines dates back to the year 1905 when the Bureau of Agriculture began to import plants from Hawaii. The importation continued

until 1908, during which time more than two million plants were obtained and distributed throughout the Islands. It was at first believed that sisal was superior to maguey, and considerable interest was therefore taken in its cultivation. Recently, however, it was found that the sisal plant has a slower growth and a shorter life than the maguey. Its fiber also is neither more abundant nor of a better quality than that of the latter. Therefore enthusiasm in its cultivation in preference to maguey has considerably subsided, and it is now mostly grown in very small patches in connection with the latter.

During the last two years some sisal fiber has undoubtedly been produced and exported under the name "maguey." This is due to the fact that the producers recognize it as a variety of maguey. This confusion is also due to the retting method by which both fibers are cleaned, and which destroys their distinctive characteristics and renders their identification by buyers very difficult, if not practically impossible.

The sisal plant also grows luxuriantly and reaches its maximum growth and development here in the Philippines. It has some advantages over maguey, principally in the absence of lateral spines on the leaves, and the greater rigidity of the leaves. The absence of lateral spines makes the cultivation of sisal easier than that of maguey, and also saves the trouble of trimming the spines prior to fiber extraction. The rigidity of the leaves prevents them from breaking during strong winds, which often cause considerable damage to the maguey fiber.

What has been mentioned in the course of this article in regard to the prevalent methods of planting, cultivation, and fiber extraction in connection with maguey in the Philippines, applies to sisal without the least change or modification. Therefore, the remedies suggested for the one apply *en masse* to the other. Though the writer believes that the cultivation of maguey is, on the whole, more advantageous than that of sisal, yet he believes that both should be encouraged and developed to a much greater extent. In doing so, however, it will be necessary to distinguish between the two products and to place each on the market under its proper designation.

CORRECT TERMINOLOGY FOR THE SO-CALLED SISAL FIBERS OF COMMERCE.

By M. M. SALEEBY, *Chief, Fiber Division.*

In an article in this issue of the PHILIPPINE AGRICULTURAL REVIEW, the writer has explained that the so-called sisal fibers of commerce are distinct fibers produced by distinct species. This fact at once makes of paramount importance the question of giving them appropriate and distinctive names. Such nomenclature, however, in order to bring about the desired result, must be very generally adopted by both the commercial and scientific communities in all countries interested in these fibers. The present terminology for designating these fibers is both incorrect and confusing, and by it, it is impossible for any person to tell the identity of the fiber reported from a certain country, unless he happens to know the particular species grown there. If more than one of the three species is grown in that country, however, it will be quite impossible to tell the species of which the fiber referred to is the product.

Before the true sisal and maguey fibers became articles of commerce, the use of the terms "sisal" and "Mexican sisal" to designate the product of the Mexican species did not cause any confusion or doubt, for they could have referred to only one particular product. Now that the true sisal and maguey industries have been established in several countries, the term "sisal" can not be used indiscriminately without ambiguity. We now hear of "Mexican sisal," "Bahama sisal," "East African sisal," "Indian sisal," "Java sisal," etc., which do not designate one specified fiber, the word "sisal" being not only ambiguous but also misleading. "Mexican sisal" is the product of the species grown in Yucatan, Mexico—the henequen; "Bahama sisal" and "East African sisal" are the product of the true sisal plant; and "Indian sisal" and Java sisal" are the product of either the true sisal plant or the maguey (cantala) plant, both of which are grown in India and Java.

The product of the maguey plant of the Philippines, India, and Java is also designated by more than one term, there being no one established term even for the product of any one of the abovementioned countries. Thus we hear of the terms "Indian sisal," "Bombay aloe," "Java sisal," "cantala," "maguey," "Manila maguey," "Manila aloe," etc. The first two terms are used to designate the Indian fiber; the next two, the Java fiber; and the last three, the Philippine fiber, all of which are produced by the same plant (*Agave cantala*). The fiber manufacturers undoubtedly buy the products of the three countries, believing they are the products of distinct species, while in fact whatever differences exist between them are due to the methods used in their preparation, and partly perhaps to differences in soil and climate. Such differences, however, are not more prominent than those that exist between the commercial grades of any one fiber. Besides the above confusion, the terms applied to the Indian and Java products of this plant are also applied to the products of the true sisal plant which is also grown in both countries.

The fiber manufacturers in Europe and the United States are always loath to make any change in the names of the products they handle. This attitude on their part can be justified only when the terms used by them are accurate, distinctive, and of established general use. But since with respect to the fibers in question the terms used are inaccurate, ambiguous, and indistinctive, it becomes necessary to drop these and adopt in their place other distinctive terms which will remove any ambiguity or inaccuracy.

To obviate such confusion and inaccuracy as are now encountered in the present system of nomenclature for these fibers, it is necessary to substitute another system which shall involve a fewer number of terms which are both accurate and distinctive, and which are, on the one hand, not altogether foreign to the markets of the world, and, on the other, not foreign to the producers. The writer recommends the following terms, which, it is believed, can come into general established use without any difficulty or confusion:

Henequen, to be used to designate the fiber produced by the Mexican species of the same name (*Agave fourcroydes*); *sisal,* to designate the fiber produced by the true sisal plant (*A. sisalana*), which is now grown commercially in the Bahamas, Hawaii, East Africa, India, Java, and other countries; *maguey* (can-

tala),[1] to designate the fiber produced by the maguey plant (*A. cantala*), which is also grown commercially in the Philippines, Java, and India. With each of the last two terms it will be appropriate to use the name of the country in which the fiber is produced, such as "East African sisal," "Bahama sisal," "Manila maguey" (cantala), "Java maguey" (cantala), "Indian maguey" (cantala), etc. In the case of henequen, however, it is not necessary to prefix the name of the country in which it is produced, as it has not yet become of any commercial importance outside of Mexico.

---

[1] The word "maguey" is retained because the term "cantala" is, as yet, foreign to commerce. It is, however, intended that as soon as the latter becomes more known, the term "maguey" can then be dropped.

"Maguey" is used in preference to any of the other terms used in Java and India for the reason that it is better known and more distinctive in this case than the latter. This choice is made notwithstanding the fact that several agave species in Mexico are known as "maguey" none of which have so far become of any commercial importance.

CURRENT NOTES—APRIL.

NOTES BY M. M. SALEEBY, Chief, Fiber Division.

BURÍ RAFFIA.

The true raffia fiber of commerce is produced by the raffia palm of Madagascar, *Raphia ruffia* (*R. pedunculata*). It is obtained from the cuticle, or epidermal layer, of the leaflets before they are fully expanded. The leaves are cured the same day they are cut and the thin, epidermal, fibrous strips are divided into narrower strips, ranging from $1\frac{1}{2}$ to 2 centimeters in width and about 1 meter or more in length. This division is made by means of special combs similar to those used in dividing hat straws or fibers. This raffia is used in the United States as a substitute for Russian bast as tie bands by gardeners and nursery men. In England it is woven into a superior matting for covering walls as a substitute for tapestry. In Madagascar the natives use it for making hats, mats, and as a tying and wrapping material. It is said that the preparation of raffia both for domestic and commercial uses is one of the most extensive household industries in Madagascar.

The true raffia palm is not found in the Philippines, but a similar raffia has for some time been prepared from the leaflets of the burí palm (*Corypha elata*) by the Filipinos. The method used in preparing this raffia is similar to that used in Madagascar. Samples of true raffia from Madagascar and burí raffia have recently been received by the fiber division of this Bureau, and comparative tests of them were made. The burí raffia was superior to the true raffia in color, fineness, and luster; but the latter proved to be about 30 per cent stronger. The strips intended for the strength tests were 40 centimeters long and 1 centimeter wide, and the results of the tests were as follows:

Sample No.—	Breaking strength in kilograms.	
	Raffia.	Burí raffia.
1	10.3	4.5
2	6.4	5.1
3	7.9	6.65
4	6.8	4.35
5	6.35	4.9
6	10.3	6.8
7	7.25	7.2
8	6.45	5.5
9	8.2	9
10	8.1	6
Average	7.8	6

It is believed, however, that if the burí raffia is prepared so as to be of the same thickness as that of the true raffia, it will prove to be equally as strong as the latter. Hence there is no reason why the burí raffia of the Philippines can not be employed for all the purposes for which the Madagascar raffia is used. Burí raffia might probably be used in preference to the latter in all articles in which color and luster are essential qualities.

PACOL FIBER.

Pacol is a species of *Musa* which closely resembles the sabá (banana) variety of the Philippines in its general outward appearance. It is extremely hardy of growth and produces a large number of huge stalks which are pale green in color. The leaves are similar to those of most banana varieties, though as a rule they are wider and less tapering than the latter. The seed pod is generally cylindrical in form, about 6 to 8 centimeters in length and circumference, and full of large black seeds similar to those of abacá, though considerably larger in size.

The pacol plant may be seen growing along the bases or lower slopes of mountains in several of the larger islands of the Archipelago, but more especially in Mindanao, Negros, and southern Luzon. In certain localities in southeastern Mindanao and in Negros, pacol spreads so rapidly and grows so luxuriantly as to actually become a menace to adjoining plantations. It is propagated from seed by birds which are fond of the fleshy part of its pods.

Pacol, like any other species of *Musa,* produces a fiber which is said to be stronger than that of the banana, but undoubtedly much weaker than abacá. It may therefore be suitable for use in the lower grades of binder twine, but not for cordage purposes. It is prepared for commercial purposes in southern Luzon, and is usually of an inferior grade, for, owing to its weakness, the strippers are forced to loosen the tension of the knife on the table.

The pacol fiber has a value equal to that of the lowest grades of abacá, or slightly less. It is so similar to one or the other of the low grades of abacá that only experts can distinguish it from the latter. For this reason, pacol is sometimes mixed with abacá, especially when a shortage in the latter is expected. This practice is extremely unfortunate and every attempt should be made to discourage it. Abacá ranks as the premier cordage fiber because of its superior strength. If this quality is lowered or in any way impaired by mixture with a weaker fiber, abacá will

lose the characteristics for which it is particularly desired. Uniformity in strength is just as essential for many purposes as the absolute quality itself. The weak and the strong fiber have their respective use and value, when kept separate; once they are mixed together, however, the value of the mixture is of necessity reduced to that of the weaker fiber. It is an established fact that the strength of a rope or cable is determined by the strength of its weakest part. If such a part is too weak to stand the necessary strain, then the whole rope is discarded as worthless for that particular purpose. Thus it is feared that if the practice of mixing pacol with abacá is allowed to continue, the reputation of abacá may be seriously injured.

THE ABACÁ SITUATION IN NORTHEASTERN LEYTE.

During the month of January of this year, Mr. F. P. Nickles, of the fiber division of this Bureau, made a trip through the municipalities of Burauen and Dagami in northeastern Leyte for the purpose of securing seed from the principal abacá varieties grown there. The seed was intended for planting at the La Carlota experiment station, Occidental Negros, in connection with abacá and other fiber experiments that are being conducted there. In securing such seed, Mr. Nickles had occasion to visit a large number of the plantations and his report on conditions as they existed there at the time is here reproduced:

During the month of January I had an opportunity to visit the abacá plantations in the vicinity of Burauen and Dagami in the Province of Leyte and the following notes refer to that district.

The feeling shown among the abacá planters was, in some respects, peculiar, for between the losses caused by the drought of last year followed by the typhoon of November and the present excellent prices for the fiber, they were uncertain whether to feel elated or depressed. In reality the situation is rather serious. The planters at the time were stripping those plants which were blown over or otherwise damaged by the storm. As the abacá stalks after injury soon become partly decayed, causing discoloration and weakening of the fiber, the result is an increased production of inferior fiber. The effect is not felt so much now as it will be a few months hence. A large part of the injured abacá which comprises most of the mature stalks is already harvested and within a few months the planters will have to clean immature stalks or wait until the new stalks will have attained their full growth. I believe that the drought and the typhoon have set back the abacá crop from six to eight months.

The situation is not hopeless, but a great deal depends upon the planters themselves. In no province in the Islands are reforms in the industry needed more than in Leyte, and there should be an added incentive to inaugurate some of them, such as the practice of better methods of cultivation and harvesting, a stand for proper prices for the better grades of

fiber from the middlemen, and the elimination of the middleman wherever possible.

The production of abacá has fallen off perceptibly since December of last year and at the present time large quantities of inferior fiber are being produced, and it is a question whether the present prices will hold until the abacá plants regain their normal stage of growth. The steadily increasing demand for abacá fiber of the better grades is a fair assurance that the prices of these grades will continue good, and good prices should encourage the planter and give him an opportunity to improve his plantation as well as the product.

PHILIPPINE SABUTAN HATS.

The sabutan plant of the Philippines was first described by Blanco under the name *Pandanus sabutan*. Recently, however, it has been identified as a variety of *Pandanus tectorius*. This plant is of common occurrence here in the Philippines, where it is commonly grown in gardens as an ornamental plant. In a few localities, more especially in Mabitak, Laguna, it is grown somewhat extensively for economic purposes, such as the manufacture of hats and mats from the leaves.

A very strong and durable kind of hats, now known to local trade as "sabutan hats," is made from the young leaves before they are fully expanded. At this stage the leaves are of a pale-greenish color and about 1½ or 2 meters in length. Immediately after they are cut, the lateral and dorsal spines are trimmed off and the leaves are dried in the sun for a period of two hours or longer. After this partial drying the leaves are divided in the middle, the midrib is removed, and each half of the leaf is subsequently split into narrower strips by a comb-like instrument, the width of the strips depending on the grade of the hat required. After the splitting operation is completed a blunt-edged bamboo blade is passed over these strips for the purpose of removing all projecting fibers formed during the operation of splitting. After this operation is completed, the strips are then boiled in clean water for about one and one-half hours, after which they are soaked in cold fresh water for two days. At the end of this period the leaves are again washed and are afterwards spread in the sun until they are quite dry. Then the same bamboo knife that was used before is again passed over the strips, this time to give them a smooth and glossy appearance, after which the strips are ready to be woven into hats.

The above process of preparing the sabutan strips for hat making is identical with that used in the preparation of the

leaves of the panama-hat plant for the same purpose. The sabutan hats are also very similar in appearance to, and are quite as strong and durable as, the latter, if not more so. The only qualities in which a panama hat is superior to a sabutan hat are pliability and color. The superior pliability of the panama hat is probably due to the leaf of the plant being naturally softer and more pliable than the sabutan leaf. The panama hat is also of a superior color, which is either due to a better process of bleaching, or to a stronger affinity for bleaching, probably more to the former. Its color is also more uniform than that of the sabutan hat, which is unquestionably due to a more careful selection of leaves of uniform color and development.

The sabutan hat as it is at present made and bleached does not retain its color for any reasonable length of time, and requires bleaching oftener than the ordinary person cares to have this done. The writer believes that the sabutan hat possesses many superior qualities which warrant extensive experiments and tests, designed to discover some bleaching process by which it will retain its color more permanently. Uniformity in its color, however, can be easily obtained by a more careful selection of leaves of the same stage of development.

At the present time it appears that the demand for the finished sabutan hat for the trade is not as encouraging as it should be. There is, however, a demand for the prepared leaves, or strips, which goes to show that there is no objection to the material itself on the part of buyers. Whether this demand is caused by a successful discovery of a bleaching process by some hat manufacturers or to extensive attempts and tests being made by them for its discovery can not at present be determined. The present prices [1] for sabutan leaves are as follows:

1. Leaves prepared for hat making (cured, boiled, etc.), ₱0.30 for enough to make one man's hat, if the strips are 3 millimeters wide; and ₱0.70, if the strips are 1½ millimeters wide.

2. Leaves cut in half only, with midrib and spines separated, ₱1 to ₱1.20 per kilo.

It is believed that until such time as sabutan hats suitable in every respect to the requirements of the market can be made, it would be advisable for all owners of sabutan plantings to prepare and sell the material in any of the above forms, if the prices are considered a sufficient inducement.

---

[1] Given by Messrs. G. Martini & Co., Manila, who are willing to buy any quantity at the above-quoted prices.

NOTES BY P. J. WESTER, **Horticulturist.**

NEW LIGHT ON THE NITRATE FIELDS OF CHILE.

According to Mr. W. S. Myers, the Chilean delegate to the Eighth International Congress of Applied Chemistry, the world might well have been spared the nitrogen-famine panic of some years ago. Mr. Myers thus sums up the situation: "First of all there is a vast amount of unsurveyed nitrate ground on the Chilean pampas that is, nevertheless, known to contain immense quantities of nitrate of soda. Second, grounds already surveyed still contain enormous quantities of nitrate. There are probably, in round numbers, one billion tons in the deposits of Chile, and, without doubt, large supplies also exist on land now but incompletely prospected. The surveyed and certified tonnage opened up at the present time already for extracting is fully 250 million tons. The probable life of the surveyed deposits is at least 400 years, even allowing for a steadily increasing annual rate of consumption."

AGRICULTURAL DEVELOPMENT OF LATIN AMERICA.

Notwithstanding frequently recurrent revolutions the Latin-American States are forging rapidly ahead agriculturally and industrially.

The wheat exports of Argentina, perhaps the most advanced of the South American republics, now surpass those of the United States. In the Province of Cordoba the Pichana River will be dammed for irrigation purposes at an estimated cost of 3 million pesos, and in another province, La Rioja, a survey has been authorized for the construction of an irrigation system to make use of the Famatina waters. The Argentine Government has also engaged the services of a Japanese to conduct experiments in rice culture in the Province of Missiones. In August, 1912, 97,081 tons of sugar were produced from 1,486,036 tons of cane in Tucuman.

In Brazil plans have been prepared for a reservoir in the State of Parahyba at an estimated cost of two million pesos. This reservoir, which will be on the River Peixe, will have a capacity of 219,250,000 cubic meters and will irrigate an area approximately 60 kilometers in length and 18 kilometers in width.

Cuba produced 1,895,984 tons of sugar in 1911–1912, an increase of 412,533 tons over the preceding season.

Both in Nicaragua and Panama there is increasing interest in banana growing. The Rio Grande Valley of Nicaragua is expected to export 30 to 40 thousand bunches of bananas per

week by the end of the current year. On some of the tributaries of the Rio Grande, such as Karawalla, banana growing is expanding rapidly at the expense of stock raising, hitherto the chief industry in that part of the Republic.

STOCK RAISING IN BRITISH EAST AFRICA.

It is not generally known that the highlands of British East Africa are eminently suited to pastoral pursuits. Notwithstanding the situation of the country in the equatorial belt, the climate, due to the altitude, is ideal, and the land is well watered and rain abundant. In this the country is very similar to our own highlands in Mindanao. The "fly in the ointment" or flies rather, are the presence of Texas fever, African coast fever, pleuropneumonia, trypanosomiasis, the tse-tse fly, and, in isolated districts, rinderpest. However, a well-organized department of agriculture is said to have these diseases well under control.

The British Government has now been experimenting for some ten years with breeding the native humpbacked cattle to Shorthorns, Ayreshires and Herefords with the result, according to the "Outdoor World and Recreation," that they have greatly improved the native cattle.

Sheep raising is also said to be very profitable and a new race has been produced, well adapted to the conditions and yielding an excellent wool, by crossing the native black fat-tail sheep with imported pure-bred merinos.

THE PROFITS IN PINEAPPLES.

The Bureau is in receipt of a communication from Mr. J. E. Higgins, horticulturist of the Hawaii Agricultural Experiment Station, of which the following excerpt should be of interest to the prospective pineapple grower in the Philippines. The quotation refers to the pineapple in Hawaii: "The yield of fruit per acre [1] ranges from 10 to 20 tons and is produced approximately once in two years. This great variation in yield is partly due to the difference in the methods of planting. Some soils seem to take care of 10,000 plants per acre, while most of the land planted to this crop in Hawaii supports only 5,000 plants. The price received for the fruit at the cannery varies from $17 to $25 per ton for first-quality fruit weighing 3 pounds (1.35 kilograms) each and upwards. Smaller fruit than this brings half price and is used in the manufacture of the cheaper grades of the canned product. At these prices the industry is here regarded as a very profitable one."

---

[1] 1 acre equals 0.4 hectare.

RINDERPEST SITUATION—MARCH 1, 1913.

By STANTON YOUNGBERG, *Supervising Veterinarian.*

Ambos Camarines.—The only known infection in this province is in the municipality of Magarao, the last report showing one infected animal.

Cagayan.—Rinderpest exists in the municipalities of Aparri and Lallo. In Aparri there were deaths of over a hundred head of cattle, the majority of which were very susceptible animals that had been brought in from Fuga and other islands to the north. The virulence of the disease in this outbreak is on the decrease.

Ilocos Norte.—In the province there are at present 4 infected municipalities: Dingras, Solsona, Piddig, and San Nicolas, involving nine barrios. Dingras was the only municipality that showed new cases during the week ending March 1. The force engaged in rinderpest eradication consists of one Bureau of Agriculture veterinarian and 10 Filipino inspectors employed by the province. The local officials and the people have given splendid coöperation.

Isabela.—The last known case of rinderpest occurred in Ilagan. The disease in this province is of a mild type with a low mortality and for this reason does not cause much alarm among the people.

La Union.—At the beginning of the year this was the worst infected province in the Archipelago. On March 1 there were only 2 infected municipalities, Luna and San Fernando, with 1 barrio in each, that in Luna being the only one with a new case during the previous weeks. The provincial and municipal officials have given excellent coöperation with the result that the province of Union shows promise of being free from rinderpest in a few weeks.

The Bureau forces have been admirably assisted by six companies of Philippine Scouts, without whom it would have been impossible to enforce the effective quarantines that have resulted in cleaning up a badly infected province in a few weeks'

time. All of the municipalities of Union Province, the adjoining *rancherías* of Benguet, and all of the municipalities and townships of Amburayan subprovince have been under a fifteen-day tie-up and thoroughly inspected by the Bureau of Agriculture forces and Philippine Scouts. This same system has now been inaugurated in the southern portion of Ilocos Sur, and it is proposed to continue northward into Ilocos Norte with the object of making a thorough clean up of the entire Ilocos coast.

In the months of September and October the towns of Balaoan, Luna, and Bangar were found badly infected. At one time there was a total of 29 infected barrios. This was before the arrival of the Philippine Scouts. During this period, the quarantines were enforced with the assistance of the Philippine Constabulary, 60 soldiers being detailed for that purpose. In spite of the fact that this outbreak occurred in the midst of the rainy season, the men having to wade daily through mud and water, the work progressed so favorably that on the arrival of the Scout forces only one barrio of Luna was infected, the disease in Balaoan and Bangar having been entirely eradicated.

In all infected barrios, whenever possible, all carabaos and cattle have been placed in individual corrals, from 20 to 30 meters apart, provided with individual drinking vessels and cans for disinfecting the feet of the caretakers. By this method it has been found possible to eradicate the disease in a short space of time as unnecessary contact between animals is avoided and they can not run loose over the pasture fields, thus disseminating infection.

Mountain.—The only portion of this province infected with rinderpest has been the subprovince of Amburayan. Two towns were originally infected, Suyo and Tagudin, the former having been cleaned up in the month of December and the last case in the latter having occurred on the 3d of February. As mentioned above, the work in this province was carried on by the same forces that searched out Union Province, and the same system of individual corrals was employed in the infected barrios. Before the arrival of the Philippine Scouts in February, the Bureau forces were admirably assisted by the Philippine Constabulary.

Pampanga.—Pampanga at present is the center of interest and activity in the rinderpest campaign. During the week ending March 1 infection was recognized in 12 municipalities, involving 47 barrios. During this period 115 new cases were

discovered by Bureau employees or reported by municipal presidents, and 96 deaths occurred.

Two companies of Philippine Scouts are on quarantine duty in this province.

Pangasinan.—The only towns now infected are Dagupan and San Nicolas, with 3 and 2 barrios, respectively. During October Manaoag was badly infected, and in November and December a great deal of infection was discovered in several barrios of Santa Barbara and Urdaneta. The people of these places recognized the gravity of the situation and rendered good assistance, with the result that the disease has been eradicated in the three towns. The disease in this province has caused a mortality of less than fifty per cent with the result that the people do not become alarmed until it has spread over a considerable extent of territory and assumed serious proportions. The Bureau forces are being assisted by two companies of Philippine Scouts.

Zambales.—Rinderpest exists in 6 barrios of Masinloc and in 4 barrios of Palauig. The latest reports show 16 new cases in Masinloc and 26 in Palauig. The remaining municipalities of the province have been searched for disease by Bureau forces assisted by two companies of Philippine Scouts and are free from infection. There is at present one company of Philippine Scouts on quarantine duty in the two infected municipalities. The work in Masinloc has been rendered very difficult by the fact that the disease was found in herds of half-wild range cattle, which can not be easily isolated in individual corrals.

Visayas and Mindanao.—No rinderpest infection is known to exist in this territory. The last remaining centers of infection in Bohol, Iloilo, and Antique were cleaned up by the middle of January, 1913.

ANNOUNCEMENT.

The "International Rubber and Allied Trades Exhibition" will be held in London in June, 1914. In connection with this an "International Cotton, Fibers, Tropical Products, and Allied Trades Exhibition" will also be held at the same time in an adjoining building.

The general principle of the rubber exhibition is well known on account of the previous exhibitions held in London and last year in New York. The combined exhibition of next year promises to be one of the most interesting and beneficial exhibitions ever held, and every country which is interested in one or more of the phases of this exhibition should be represented for the benefit of its trade and commerce.

The tropical-products section of this exhibition will be held under the auspices of the Tropical Agricultural Association of which Professor Wyndham Dunstan, C. M. G., director of the Imperial Institute, is president. His Majesty King George V is patron; Sir Henry A. Blake, G. C. M. G., is president; and the Right Honorable Lord Elphinstone is vice-president.

Full prospectus of this combined exhibition will be issued in a few months.

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Vacant.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Assistant Horticulturist, H. H. BOYLE.

Entomologist, C. R. JONES.
Assistant Entomologist, D. B. MACKIE.

AGRICULTURAL INSPECTORS.

H. R. REED.
W. A. MACE.
F. P. NICKLES.
F. C. KINGMAN.
H. O. JACOBSON.
I. C. ROOT.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	P. J. WESTER, Horticulturist in charge.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	E. F. SOUTHWICK, Acting Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	Vacant.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

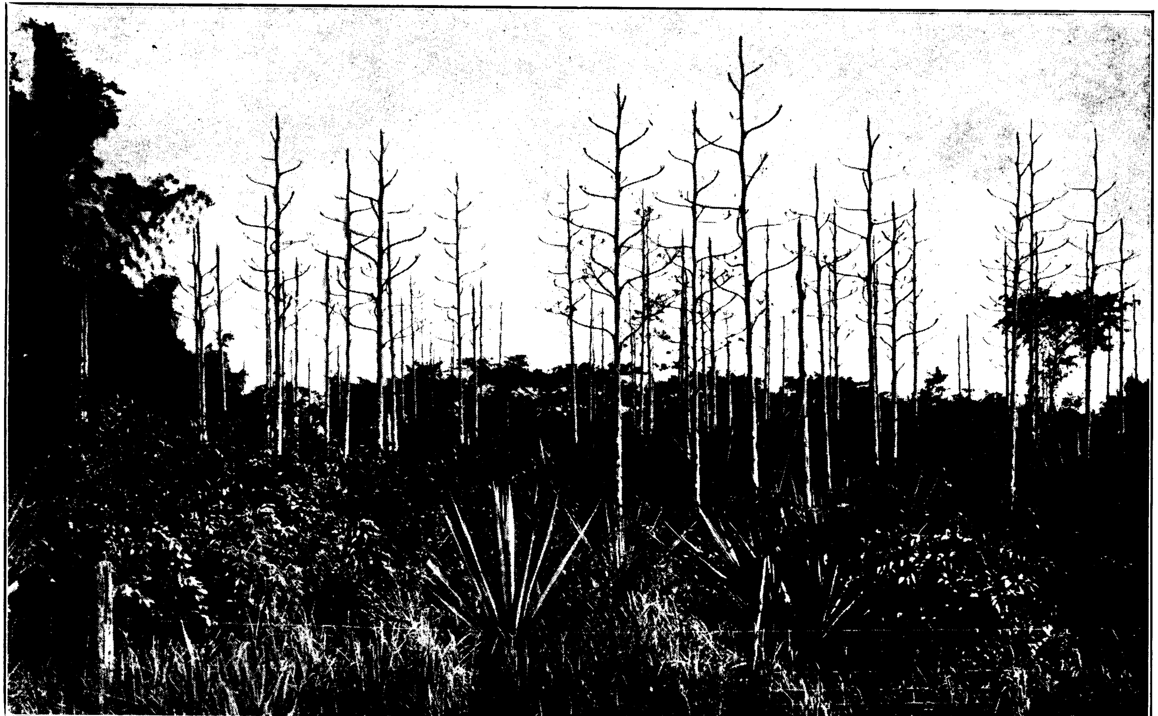
SUPERVISING VETERINARIANS.

Charles G. Thomson.
Stanton Youngberg.
Charles H. Leavitt.

VETERINARIANS.

J. B. Bell.
W. R. L. Best.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. A. Curtis.[1]
W. L. Davis.
Charles H. Decker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.[1]
A. H. Julien.
Harry F. Kern.
William A. Kilphardt.
Walter A. Korb.
A. M. Meade.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.

[1] On leave.



Seven-year-old sisal plants at the "poling" stage, Lamao Experiment Station, Bataan (illustrating how lack of cultivation and harvesting induce early maturity).

THE PHILIPPINE

Agricultural Review

VOL. VI MAY, 1913 No. 5

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

THE PHILIPPINE VETERINARY MEDICAL ASSOCIATION.

By the ASSISTANT TO THE DIRECTOR.

The work of controlling and eradicating the diseases of domestic animals may well be considered as the building of a permanent foundation upon which the structure of industrial development in the Philippine Islands may be safely erected. The industrial prosperity of this country is based on its agriculture, and the most important branch of Philippine agriculture is the production of the food supply of the Islands. Our two leading food products, rice and maize, can not be successfully cultivated on a large scale without an abundant supply of work animals—a condition which can exist only when rinderpest is under control or entirely eradicated.

The vital importance of the rinderpest campaign has been fully appreciated and has received the hearty support of the Government. In general, it has received, also, the support of the people of the Islands. During earlier years, when the necessity for using vigorous measures in fighting rinderpest was not well understood, considerable opposition was encountered. While this feature of the campaign has not been entirely eliminated, it has been largely reduced, and in most provinces the local officials and the farmers give their hearty support in the rinderpest work.

For several years a large number of veterinarians have been employed by the Bureau of Agriculture. In addition to this force, we have in the Islands the veterinarians of the Army and those in private practice. In connection with the different lines of veterinary work carried on in the Philippines there are constantly arising problems, both technical and administrative, which are of interest to, and which should be considered by, the entire veterinary profession as it is represented in this country. Realizing the desirability of an organization that might facilitate such action, there was organized some years ago the Philippine Veterinary Medical Association. This association now includes in its membership the greater part of the veterinarians in the Philippine Islands, and it has been an important factor in promoting the larger interests of the veterinary work.

The individual members of the Philippine Veterinary Medical Association are engaged in a work of the utmost importance and one that can not fail to be of interest to veterinarians throughout the world. The nature of this work, the measures that are used, and the results that are obtained should be fully and clearly understood, not only in the Philippines, but also in other countries where trained men are endeavoring to control and eradicate the diseases of domestic animals. The Philippine Veterinary Medical Association, if properly supported, will be of inestimable benefit to the veterinarians of these Islands, and indirectly to the people for whom the veterinary work is being carried on. It should, furthermore, be the principal means by which information may be furnished the entire veterinary profession regarding the animal-disease campaign in the Philippine Islands.

BUREAU OF AGRICULTURE CIRCULAR No. 22—MAGUEY (CANTALA) AND SISAL CULTURE.

[CIRCULAR No. 22. Manila, March 29, 1913.]

MAGUEY (CANTALA) AND SISAL CULTURE.

By M. M. SALEEBY, *Chief, Fiber Division.*

INTRODUCTION.

The maguey plant of the Philippine Islands (*Agave cantala* Rox.), the true sisal plant (*A. sisalana* Per.), and the henequen plant of Mexico (*A. fourcroydes* Lem.) are the species which produce the so-called sisal fibers of commerce. Of these the last (henequen), which is practically exclusively grown in Mexico, is by far the most important, and its product constitutes about 80 per cent or more of the world's total production of sisal. The first two, however, produce a fiber as good in quality as henequen, if not slightly superior. They also endure variation in soil and climate better than the latter, hence the interest in their cultivation has recently considerably increased, and they are now grown on a more or less large scale in several tropical countries both in the Eastern and Western Hemispheres. The details connected with their planting, cultivation, and fiber production are essentially the same, which fact explains their treatment under one subject.

The essential features of maguey and sisal culture which should recommend them to the Filipino planters are their peculiar adaptability to conditions prevailing in certain parts of the Philippine Islands. These conditions may be summed up as follows: A long dry season; large tracts of rocky and somewhat impoverished soil; the prevalence of locusts and other insect pests; the scarcity of skilled labor; and the lack of sufficient capital for the purchase of work animals and agricultural implements and machinery. Maguey and sisal will flourish in comparatively poor rocky limestone soils and will withstand long periods of drought; their cultivation is both simple and inexpensive, not requiring skilled labor, work animals, or agricultural machinery; and they are not attacked by any serious diseases or insect pests.

The cultivation of sisal and maguey for fiber production has recently been successfully accomplished in several tropical countries which apparently have no advantage over the Philippines in regard to any of the essential requirements. Thus we hear of the successful cultivation and production of sisal in the Bahamas, East Africa and Hawaii, and of maguey and sisal in Java. The maguey and sisal plants are very widely distributed throughout the Philippines, the former having been grown here for many years while the latter was introduced about eight years ago by the Bureau of Agriculture. Both plants appear to flourish and attain their maximum extent of growth and development, nevertheless their cultivation has not been so successful as in other countries. The production of maguey in the Philippines for commercial purposes did not begin until the year 1904. Since 1906 the industry has practically remained stationary with no material improvement in the cultural methods nor an increase in the area cultivated or amount of fiber produced. The production of sisal from German East Africa has increased from 1,854 tons in 1906 to about 9,000 tons in 1911, while the production of maguey in the Philippines has increased from 2,443 tons to 4,270 during the same period. The exports of maguey from the Philippines during 1912 show an increase of about 2,000 tons over those of 1911, due only to a temporary rise in the value of the fiber; while the exports of sisal from German East Africa show a gradual and substantial increase every year since 1904.

A recent reawakening of general interest in the cultivation of maguey and sisal in the Philippines has been exhibited by planters in several provinces. A noticeable increase in requests for information regarding various phases of the industry and for suckers and bulbils has confirmed the above reawakening. It is therefore the aim of this circular on the one hand to furnish the required information, and on the other to indicate the lines upon which present methods should be improved in order to bring about the desired development of the industry. Information of a more detailed nature will be given later in a special bulletin on the subject.

SISAL AND MAGUEY.

It appears to be a general belief among the planters in the Philippines that sisal and maguey are varieties of the same species, and that further than the absence of the marginal spines on the leaves the latter is the same as the former. It is, there-

fore, important at this point to correct this impression by giving a description of both plants, which will show plainly the real, though not very marked, differences between them in their outward appearance, their habits of growth, and the relative qualities of their fibers. Though the same methods are used in cultivation, the two plants are separate species, producing somewhat distinct fibers, and they should be raised separately and their fiber produced and marketed separately.

Sisal.—This plant endures variation of soil and climate, hence the fact that it is very widely cultivated throughout the Tropics. It is even known to grow in semitropical countries where some frost occurs, but its best development is obtained in tropical countries having a somewhat dry climate and well-drained limestone soil. The first harvest of leaves is ready for fiber extraction about four years from planting, and with proper care and cultivation the plant lives eight to ten or more years. The leaves are green or light green in color, rigid, and characterized by the total or partial absence of the marginal spines. When cleaned by machinery the fiber is white or slightly yellowish in color and of good luster. If cleaned by the retting method, the fiber is of a dull-gray color. Well-cleaned sisal is now quoted at about 32 to 34 centavos per kilo in the New York market, while hand-cleaned sisal sells 4 to 6 centavos less than the former. The fiber is designated by the word "sisal" used after the name of the country in which it is produced, such as "East African sisal," "Hawaiian sisal," etc.

The sisal plant was introduced into the Philippines from Hawaii about seven years ago by the Bureau of Agriculture. Though several million plants have been introduced and distributed, it is nowhere cultivated on a large scale, its cultivation being so far restricted to small patches in connection with maguey.

Maguey.—This plant endures variation of soil and climate as much as if not more than sisal. It is cultivated in the Philippines, Java, and British India, where it must have been introduced a few hundred years ago from Mexico. It lives ten to twelve or more years providing it is cultivated and harvested periodically. The requisite soil and climate conditions with which its best development can be obtained are the same as those for sisal. The first harvest of leaves can be gathered three and one-half to four years from planting. The leaves are of a grayish-green color and are longer, somewhat narrower, and less rigid than sisal leaves. They also differ from the latter

in having many prominent marginal spines similar to those on the henequen leaves. The fiber, when cleaned by machinery, is somewhat finer, whiter, and probably more flexible than sisal. The retting method of cleaning destroys the choice and distinctive qualities of this fiber and renders it identical with, though perhaps slightly finer than, retted sisal, hence the difficulty of distinguishing the two fibers as exported from the Philippines. Maguey is exported from the Philippines under the name of "Manila maguey," "Manila aloe," and "maguey."

The above description makes clear the following important facts: First, both the sisal and maguey plants, though somewhat resembling one another in their general outward appearance, are distinct species, producing distinct fibers which have different commercial values; second, the two species require practically the same soil and climate conditions for their best growth and development, and their fibers can be extracted by identical methods; and third, the only hope of their attaining more commercial importance in the face of competition from henequen and other hard fibers lies in the employment of machinery for cleaning their fibers.

CLIMATE AND SOIL.

The maguey and sisal plants endure variation of soil and climate better than most other tropical plants of economic importance. They do not require as abundant and evenly distributed a rainfall nor as rich a soil as are required by abacá (Manila hemp), coconuts, coffee, cacao, and other tropical crops. In a rich soil and a wet climate maguey and sisal apparently grow luxuriantly, but the quality and yield of their fiber are not as a rule at their best; besides, under these conditions the cost of cultivation and fiber extraction is considerably higher than in a poorer soil and a drier climate.

A long dry season and a short rainy one may on the whole be considered essential for the best growth of these plants and the development of their fiber. Their thick and pulpy leaves render them capable of withstanding long droughts which would be disastrous to most other economic tropical plants. Frost and sudden changes of temperature, especially the former, however, are undesirable.

Well-drained limestone soils, such as are formed by the disintegration of coral rock, appear to be best suited for growing sisal and maguey for fiber production. Even though such soils are in most cases stony and hard, good results are obtained, for

these plants are very hardy and their roots can penetrate such soil to a sufficient depth to enable them to obtain the required amount of nourishment necessary for their development. This, however, should not be construed to mean that they flourish in rocky land devoid of soil of sufficient fertility. Sandy soils, such as occur near the seabeach, often give fairly good results, providing they are sufficiently distant from the reach of salt water. All low or swampy land in which standing water comes in contact with the roots or in which the water takes a long time to run off should be avoided. These plants do not thrive in wet soils, for their roots are sensitive to moisture and in such soils they either die outright or linger on in an unhealthy condition.

PROPAGATION.

Sisal and maguey produce suckers and bulbils, or "pole" plants, but no seeds. Their propagation therefore can be effected only by the use of either of the first two means.

Suckers appear about the second or third year from planting. They grow around the mother plant and spring from the underground runners, or rhizomes. From 30 to 40 suckers are ordinarily produced by one plant during the first four years of its age, after which the number decreases until the plant has reached the "poling" stage. Suckers intended for planting should be dug up when they have attained a height of 15 to 25 centimeters, and should be secured, if possible, from plants between 4 and 6 years of age. If they are somewhat dried, the suckers can withstand shipment for long distances. They are usually set out in the field without any preliminary operation, except perhaps trimming off the older leaves.

Bulbils, or "pole" plants, are produced on the branches of the flower stalk which grows from the center of the plant at the time it reaches maturity. When the flowers have withered and fallen to the ground, the flower stalk does not immediately die, but at the ends of the branches are produced these numerous small bulbils which eventually develop into small plants 8 to 10 centimeters in length, and then fall to the ground. These bulbils are usually set out in a nursery for a period of six to ten months, or until they have attained a height of 20 to 25 centimeters, after which they are transplanted to the permanent field. The nursery should be properly prepared and kept clean from weeds all the time. The shading of the young plants is not necessary, providing they are kept watered occasionally until their roots have established themselves.

If sufficiently dried and properly packed, these bulbils will retain their vitality for a longer period than suckers. They are also much smaller in size, cheaper to collect, and easier to pack than the latter. If a plantation is to be started in a locality where the necessary supply of suckers can be obtained from the neighborhood without much expense and difficulty, then the use of suckers is to be preferred to that of bulbils, for the former grow more quickly and can be cultivated at less expense than the latter. Only in cases where either suckers or bulbils have to be imported from distant localities or from foreign countries, will the use of the latter be preferred to that of the former.

PLANTING.

The suckers or nursery plants should be set out in straight rows not less than $1\frac{1}{2}$ by $2\frac{1}{2}$ meters nor more than 2 by 3 meters apart. Distances ranging from $1\frac{1}{3}$ by $1\frac{3}{4}$ meters to 3 by 3 meters have been recommended by various authors. The distance varies to some extent with the species cultivated and the nature of the soil. As a rule, the plants may be set out closer together in poorer than in richer soils. Also sisal plants, on account of the stronger rigidity of their leaves and the absence of marginal spines on them, may be planted somewhat nearer together than the maguey plants.

If the plants are set out closer together than $1\frac{1}{2}$ by 2 meters, the leaves (especially in the case of maguey) will cross and cut each other during strong winds, thus causing considerable damage to the fiber. Besides preventing such damage to the fiber, there are several other advantages resulting from a wider planting than is ordinarily practised in the Philippines. These are: First, to allow of the free circulation of air and access to sunlight, which will greatly stimulate the growth of the plants and tend to check the spread of certain diseases and scale pests which sometimes attack the leaves; second, to allow of the practice of the proper methods of cultivation and harvesting; third, to render possible the growing of certain secondary crops during the first two or three years of the life of the plants; and fourth, to give the roots a larger soil area from which to obtain the necessary supply of plant food, which will enable them to thrive better and perhaps live longer.

CULTIVATION.

Where the land is arid and rocky the suckers or nursery plants may be set out with but little preliminary preparation of the soil. If, however, the land is overgrown with underbrush or weeds,

as most localities in the Philippines are to a more or less extent, then it becomes necessary to clear the soil and burn the waste prior to planting. This operation should be repeated periodically thereafter in order to prevent any such growth from ever shading the plants. Wherever practicable to do so, the land may be plowed and a secondary crop raised, providing such a crop does not shade the young maguey or sisal plants nor in any other way seriously interfere with their growth and development. Where the land is thus prepared, maguey and sisal will grow unchecked and the secondary crop will considerably reduce the cost of the upkeep of the plantation until the plants can be harvested.

Besides the above operations connected with the cultivation of maguey and sisal prior to and after planting, the periodical cutting or digging up of the suckers from around the mother plants is another operation which requires the constant attention of the planter. Whether there is a demand for such suckers or not, the fact remains that under no circumstances should they be left, for as long as they remain attached to the mother plant, especially before they have become old enough to send out roots of their own, they deprive it of a large part of its nourishment and induce its early "poling." These suckers are more abundant in rich than in poor soil, and are also more abundant during the first half of the life of the plants than during the latter half.

It is frequently mentioned that maguey and sisal will thrive under conditions of neglect which would be fatal to most other economic plants. This is true to a certain extent, but it is also true that these plants respond very freely to a rational treatment along the above-mentioned lines by giving better results.

THE PLANTATION.

With a very few exceptions maguey and, to a smaller extent, sisal, is grown in the Philippines as an emergency crop of secondary importance. Rice, corn, and other crops are planted on the lowlands where the soil is rich and the supply of water abundant, while maguey is raised in small "patches" along the hillsides or on dry lowlands of poor fertility. These plantings are as a rule scattered over a large area and restricted to localities near the seabeach. Their proximity to salt water is essential as up to the present the retting of the leaves in water is practically the only method used for cleaning the fiber.

Under such conditions, of course, there has been no demand for a large and regular supply of leaves in any one locality, and it has been practically impossible for any one planter to handle

satisfactorily the output of a large plantation. As long as the retting method is used for cleaning the fiber, there can be little hope of increasing the cultivation of maguey and sisal and establishing the industry on a sound basis. A review of the history of the henequen and sisal industries in Mexico, the Bahamas, and other countries where they are now firmly established will show that they remained in a condition similar to the present state of the maguey industry here until the planters adopted systematic and modern methods of cultivation and fiber extraction. A similar progress may be made with our maguey and sisal industry, if the planters employ modern machinery for extracting the fiber. Such machines will clean from 30,000 to 150,000 leaves per day, and in order to render their operation practicable a sufficient supply of the raw material must be available. This can be accomplished only by establishing large plantations or several smaller ones in close proximity.

Whether a planter intends to establish a large plantation which would supply a sufficient quantity of the raw-material to operate a machine, or whether he intends to establish a smaller one and be a member of a community using the same machine, several important matters will require his attention and judgment. The first is the selection of the proper location for the installation of the fiber-extracting machine, which depends to a large extent on the lay of the land. If the land is hilly, it will be more convenient and more economic to install the machinery on the lower level thus avoiding the necessity of transporting the raw material uphill. If the land is level, then the location of the machine should be as near the center of the plantation as possible. The second is the construction of roads through the plantation at regular intervals, along which carts may be taken or trucks run upon suitable rails. These roads are necessary in order to facilitate the transportation of the raw material, for it must be borne in mind that for every ton of fiber produced 25 to 35 tons of raw material must be transported to the machine and almost an equal quantity in the form of waste must be hauled away and distributed among the plants for fertilizer purposes. This also emphasizes the importance of laying out the roads at such intervals as would reduce to a minimum the distance to which the bundles of leaves must be carried by hand to the cart or truck. On hilly land the roads must of necessity follow the contour of the land. The third is the importance of systematic planting in accordance with directions given under the chapter on "Planting."

Figure 1 is here given to illustrate the arrangement of a maguey and sisal plantation, whether it be large or small. It represents a section of a plantation which is 50 meters square, or one-fourth of a hectare in area. The plants are set out 1.75 meters apart in the row, with the rows 3 meters apart, thus giving approximately 2,000 plants to the hectare. A road 4½ meters wide is laid out after every 25 rows, limiting to 22½

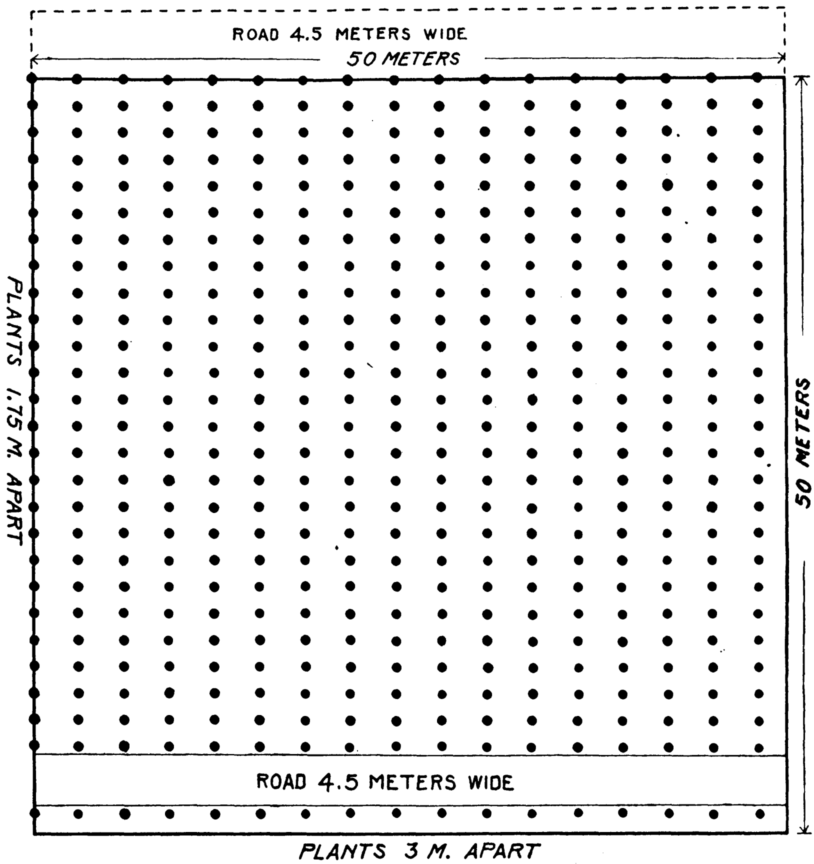


Fig. 1. Plan showing method of planting maguey or sisal.

meters the maximum distance to which the bundles of leaves are carried by hand. These roads, however, may be laid out at greater or less intervals, if in the judgment of the planter this appears to be desirable. Other important problems pertaining to the arrangement and management of the plantation often confront the planter but the nature of these problems and their solution can not be given here, for they are mostly or

entirely governed by local conditions which differ in different localities.

HARVESTING.

The fiber is obtained from the leaves and forms the most essential element in their organic structure. The fiber is of course found in the leaves at all ages, but its complete development is obtained only in mature leaves. As some leaves mature and become unable to perform their function, others are formed to replace them. To remove the fully matured leaves, therefore, does not in any way interfere with the welfare of the plant; on the contrary, it appears to accelerate its tendency to form new leaves. This fact explains why regularly harvested plants generally live longer than those which are neglected.

The age of the plant at which the first crop of mature leaves can be harvested depends to some extent on the soil and climate, and also upon the method of propagation. Under normal conditions here in the Philippines the maguey plant can usually be harvested at the middle or end of the third year from planting, while the sisal plant takes six months to one year longer. If the plants are reproduced from bulbils, both maguey and sisal will require nine months to one year longer to produce the first harvest of leaves than when they are reproduced from suckers. The same variation is also influenced by the age and size of the suckers when these are used for propagation.

Usually only the two outer rows of leaves, which consist of from 20 to 30 leaves, can be harvested annually from one plant. The cutting should commence at the beginning of the dry season; and in case there are two dry seasons in the year, two harvests can be gathered, providing not more than 10 or 15 leaves are removed from one plant at one time. The cutting should be made with a sharp knife at a little distance from the stem, care being taken not to break the leaf or injure the stem during the operation. The marginal and terminal (with sisal only the latter) spines should then be trimmed off to facilitate the handling and transportation of the leaves.

Under no circumstances should immature leaves be harvested, either from young or from old plants. It is extremely unfortunate that this ruinous practice is frequently resorted to by the Filipino planter, presumably for immediate benefit. This practice naturally obstructs the development of the plants and tends to shorten their lives by inducing early maturity. Moreover, the

fiber obtained from such immature leaves is of inferior quality, owing to its incomplete development.

EXTRACTION OF FIBER.

Retting Method.—There are two methods used in extracting the maguey and sisal fibers. The first, which is generally used here in the Philippines, is the "retting" method, by which the leaves are slit into strips, tied in bundles, and immersed in salt water. The bundles remain in the tidewater from six to eight days, during which period they are turned over a number of times so that a uniform decomposition of the pulp may be obtained. When the leaves are sufficiently decomposed they are taken out of the water and the pulp is easily beaten or scraped off. Sometimes the leaves are macerated and left until fermentation has taken place, when the pulp can be easily separated from the fiber. Both these methods, besides being tedious and laborious in the extreme, result in the production of a weak and discolored fiber.

Machinery.—During the last decade or two the fiber produced by the henequen species of Mexico, and also that produced by any of the other two allied species which are grown commercially in other countries, have been almost exclusively cleaned by machinery. The first machine invented for the purpose was the apparatus commonly known as the "raspador," which consists of a 54-inch wheel revolving inside a heavy wooden or metal case. Across the surface of this wheel are placed blunt brass knives, about 20 centimeters or more apart. In front of the wheel is adjusted a concave block, or brass shoe, against which the leaves are scraped by the blades of the former. In most raspadores the concave block can be so adjusted as to subject leaves of any thickness to the scraping knives. The leaves are fed in through a hole in the case. Usually one-half of the leaf, from the middle to the tip, is fed in first; and, when this is cleaned, the leaf is reversed and the remaining half is fed and cleaned in the same way.

All of the medium and large-sized machines, which have recently superseded the raspador on all large plantations, are constructed on the same general principle as the latter. In most of the medium-sized machines, which range in capacity from 10 thousand to 30 thousand leaves per day, each leaf is fed in twice before it is entirely cleaned, thus doubling the time and causing

a considerable waste of fiber. In the large machines, which vary in capacity from 40 thousand to 200 thousand leaves per day, this defect is rectified and the leaves are automatically fed in and cleaned with one operation. These machines perform their work at a considerably less cost than the smaller ones, and their operation is coming into more general use. These machines have also encouraged the cultivation of henequen and sisal on a much larger scale than heretofore, and have also rendered possible the use of large trucks and tramways for transporting the leaves and disposing of the waste.

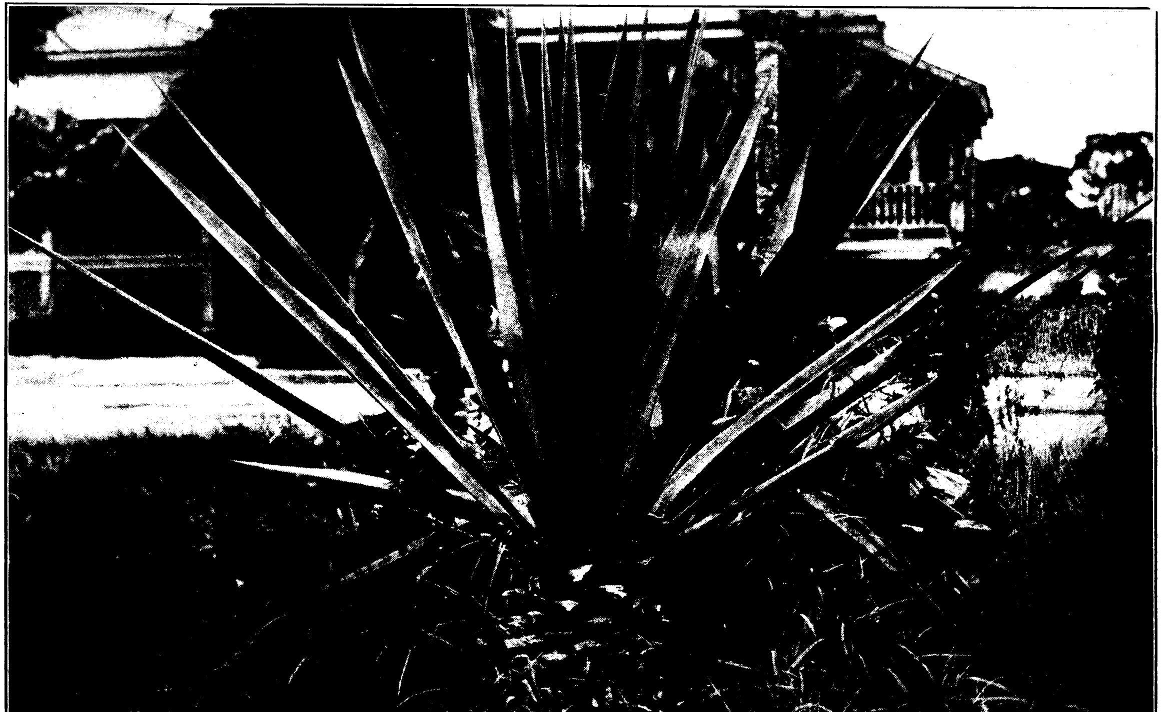
While it is not to be expected that the retting method will be immediately or entirely superseded by the use of automatic machines, it is hoped that attempts will be made by the progressive class of producers to so arrange and manage their plantation as to render the use of at least the medium-sized machines practicable. The advantages which will undoubtedly accrue from the use of such machinery, providing it is properly and intelligently handled, will encourage the establishment of larger and more systematically managed plantations, which will in turn make possible the use of the larger and more economical machines in the near future.

DRYING AND BALING.

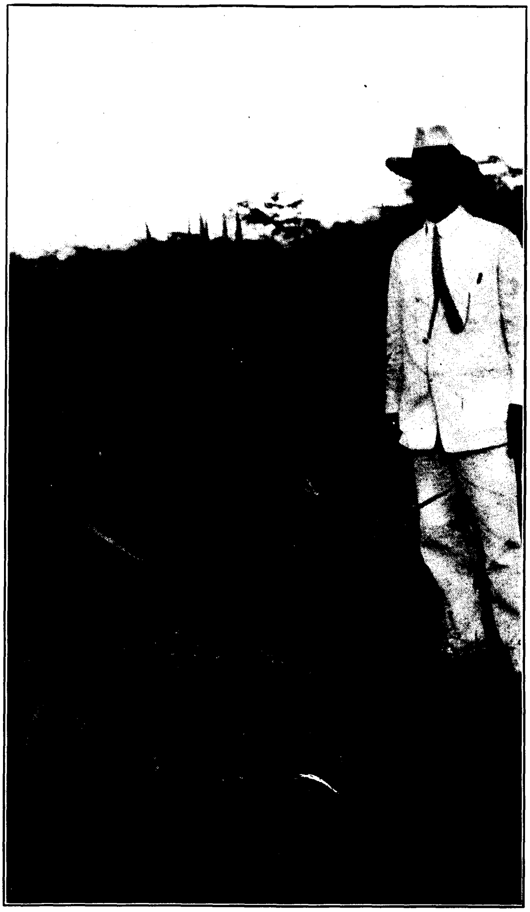
The maguey and sisal fiber, after having been cleaned by the retting method, should be washed with fresh water prior to drying, in order to remove any traces of salt that may remain. The salt absorbs moisture and, even after it has been once dried, will become wet again. If baled in a wet condition, the quality of the fiber will considerably deteriorate, if indeed it does not sometimes actually rot.

The machine-cleaned fiber as it comes out of the machine often has a green tinge to it, due to the presence of traces of the pulp. This green color disappears after the fiber has been thoroughly dried in the sun or washed in running fresh water. The washing of the fiber should not last more than a few minutes, for, if it is allowed to soak, its commercial quality will be impaired. The fiber should not be exposed to rain or dew, or it will lose its luster. Sheds should always be available, in which the fiber should be spread on lines during damp or rainy days.

Before baling, the dried fiber should be made into bundles not more than 10 to 12 centimeters in diameter, and tied near the butt end with a strand. The strands should be as small as it is



Seven-year-old sisal plant, Singalong, Manila.

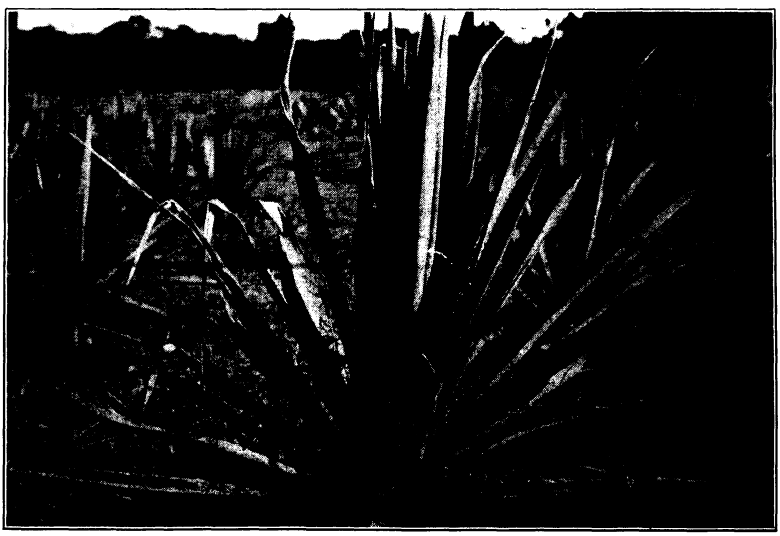


A three-year-old maguey (cantala) plant, San Miguel, Tarlac.

Maguey (cantala) plant at the "poling" stage.

Branch of sisal "pole," showing formation of bulbils, Singalong, Manila.

(*a*) Three-year-old maguey plantation, San Miguel, Tarlac, showing construction of roads at regular intervals.



(*b*) Maguey plant attacked by a fungous disease.

possible to make them and just strong enough to hold the bundle together, thus reducing to a minimum the loss in cutting and throwing them away as waste at the mill. These bundles should then be so arranged in the bale as to have the butts of one layer alternating with the tips of another. If the fiber is too long, however, it may be bent over toward the tip end, but not in the middle. In any case the fiber in the bundle should under no circumstances be twisted around in a spiral form or in a manner similar to the strands of a rope, for when it is pressed in this form in the bale for several months there will be an unnecessary waste in opening it at the mill and passing it through the carding machinery.

The fiber obtained from the first harvest of the maguey and sisal leaves is always of a much poorer quality than that obtained from subsequent harvests. This is due to the fact that the first and oldest leaves are somewhat dried up, and are always shorter and more damaged than subsequent ones. The first crop, therefore, is by no means a fair sample of subsequent crops, and it should be baled separately and so marked as to prevent any prejudice against future crops on the part of the manufacturers.

YIELD AND VALUE.

The yield of maguey and sisal from a given area depends upon the soil and climate, the distance the plants are set apart, the amount of care and cultivation given the plants, and the method of harvesting the leaves. Overcutting and early cutting always result in a decrease in the yield of subsequent crops.

It is generally estimated that 1,000 mature leaves of maguey or sisal of average size yield from 18 to 22 kilos of dry fiber. It is also estimated that every plant of a normal condition of growth will yield annually an average of 25 to 30 leaves. Allowing 2,000 plants to the hectare with an average yield of 25 leaves each and 20 kilos of dry fiber to every thousand leaves, a hectare planted in maguey or sisal should yield annually 50 thousand leaves producing 1,000 kilos of dry fiber, or one metric ton. The actual quantity of fiber in the mature leaf ranges from $4\frac{1}{2}$ to 6 per cent of its total weight. Of this quantity of fiber, however, a certain portion goes to waste during the operation of fiber cleaning, leaving an average of about $3\frac{1}{2}$ or 4 per cent of commercial fiber. By the retting method less fiber is wasted than by machinery, but the superior quality of the latter much more than makes up for the slight difference in yield.

The value of both sisal and maguey in the world's market today is somewhat above the normal. The quotations on German East African sisal during February of this year ranged from ₱330 to ₱335 per ton. The value of maguey, however, was somewhat less than sisal, ranging from ₱300 to ₱310 per ton for Cebu No. 1 and from ₱290 to ₱295 for Manila No. 1. This difference in value between sisal and maguey is due to the fact that the latter is cleaned by retting and the former by machinery. If maguey were prepared by machinery, its value would be as high as, and probably higher than, sisal.

The price of retted maguey in the Manila market during the same month was about 21 centavos per kilo for Manila No. 1 and about 23 centavos per kilo for Cebu No. 1. If the same fiber had been cleaned by machinery, its value should have been as high as 28 centavos per kilo in the Manila market. Basing our estimates at between 20 to 25 centavos per kilo as the normal value for machine-cleaned fiber in the Manila market, the gross revenue from land cultivated to maguey or sisal should be between ₱200 and ₱250 per hectare annually.

USES.

The principal use to which the so-called sisal fibers of commerce are put is the manufacture of binder twine. Of an estimated annual production of about 140,000 tons of sisal, over 110,000 tons, or about 80 per cent, are henequen from Mexico, and the remainder is sisal and maguey from several other tropical countries, including the Philippines. The bulk of henequen is cleaned by machinery, and is used for binder twine. Sisal and maguey, when cleaned in the same way, are usually considered too good for binder twine and are then used to better advantage in certain grades of cordage. When they are cleaned by the retting method, however, they are usually considered too poor even for binder twine, and they are then used as a mixture with henequen or the low grades of abacá in making the low-grade binder twine.

ENEMIES AND DISEASES.

Maguey and sisal in the Philippines are seldom attacked by any serious disease or insect pest. During the last year or two, investigations by the fiber division of this Bureau have resulted in the discovery of two fungous diseases and one insect pest, none of which is common or of a serious nature. A study of the nature of these fungous diseases is at present being made

by the Bureaus of Science and Agriculture, for the purpose of identifying them and devising effective remedies for their control, in case they spread to any serious extent in the future. In the meantime the planters should watch their plantations carefully for the appearance of any such diseases, as these can be much more easily checked in the beginning than after they have become widespread.

A scale insect known as *Aspidiotus orientalis* Nwst. was discovered some time ago by the writer on the leaves of maguey and sisal at the Lamao experiment station. This, however, can easily be checked by harvesting or cutting off the attacked leaves as soon as it makes its appearance on them. It does not spread rapidly from one plant to another nor does it injure the leaves unless it is allowed to remain on them for a long time. So far, therefore, it has not been found necessary to use lime sulphur or oily or soap washes to check it, as is being done with other scales.

Goats and cattle, especially the former, will inflict considerable damage on the maguey and sisal plants. While it may not be necessary to construct secure fences around the plantation, some kind of vigilance against the entrance of such animals will, in some cases, be necessary.

CONCLUSION.

In certain parts of the Philippine Islands, such as Ilocos Norte, Ilocos Sur, La Union, Cebu, Bohol, and Siquijor, extensive areas of land are found where the soil is too rocky or too poor for the cultivation of any of the principal crops. In these sections, as a rule, there is a scarcity of work animals and an abundance of available labor; this labor at certain seasons migrates to neighboring islands and provinces to assist in the gathering of the harvests there. In the provinces where such conditions exist, there is an urgent need for the introduction of some crop that can be profitably grown. Maguey and sisal answer all these requirements, and while the former, and to a smaller extent the latter, are and have for some time been grown there for their fiber, yet their cultivation is carried on on a very small scale and by careless and antique methods. It is safe to state that under such conditions the material development of these provinces and islands will depend more on the proper establishment of the maguey and sisal industry than on any other single crop or combination of crops that can be raised in them.

The establishment of this industry on a satisfactory basis will require three distinct lines of improvement over the present

methods now in vogue, viz, the practice of proper and systematic methods of planting and harvesting, the necessity of establishing large plantations, or a number of smaller ones in close proximity, and the introduction of fiber-extracting machinery. Systematic planting will lessen the cost of cultivation and harvesting, careful harvesting will increase the yield of fiber and lengthen the life of the plants, and cleaning by machines will considerably improve the quality and value of the fiber.

It is hoped that these lines of improvement have been sufficiently explained in this circular, and that hereafter better and more improved methods will be used to replace the present crude and wasteful methods practised by the majority of the maguey and sisal planters in the Philippines.

ADDITIONAL NOTES ON ROSELLE.[1]

By P. J. WESTER, *Horticulturist.*

It is now some years since the writer first called attention to the fact that the leaves and stems of the roselle could be utilized in the manufacture of jelly and similar products, and experiments were started by him in 1910 in Miami, Fla., under the auspices of the United States Department of Agriculture, to ascertain cost of production and yield of herbage and to obtain data relative to the conversion of the raw material into a manufactured product. Owing to the writer's serious illness during the summer of that year and his subsequent transfer to Washington, D. C., these experiments were not completed. The project had been kept in mind, nevertheless, and shortly after the introduction of the roselle into the Philippines in 1911, an abundant supply of seed being available for the work, an experimental plat was set aside at the Lamao experiment station (in 1912) and planted with roselle.

The land selected for the trial consisted of a stiff loam, well drained, rather below the average Philippine soil in fertility. No fertilizer was applied.

After being irrigated, the land was plowed, disked, and harrowed and the seed sown March 1 in drills 60 centimeters apart. The subsequent cultivation consisted of occasional hoeings to keep down the weeds and to supply an earth mulch to reduce soil evaporation. The land was irrigated whenever necessary until the advent of the rainy season, when this was discontinued. By this time the plants occupied the land so well that no further cultivation was needed. Because of lack of suitable modern machinery the labor item was excessively high; the figures are not given as they would be misleading. For instance, the harvesting of the plants was accomplished by cutting the plants with machetes (bolos). By the use of modern cultivators and harvesting machinery the cost of growing and harvesting roselle herbage would be about that of any ordinary field crop such as maize or cotton.

[1] For a full discussion of the roselle and its culture, see Vol. V, No. 3, 1912, of this REVIEW.

By April 10, the date of the first cutting, the plants averaged 50 centimeters in height and a few had blossomed and set fruit. The yield of herbage was 3,900 kilos per hectare. The plants had been cut from 6 to 10 centimeters above the ground and the weeds were now hoed out between the stubble and the land irrigated. The stubble promptly sprouted and one month after the first cutting the field was ready for a second. This yielded 4,300 kilos of herbage. A third cutting of 9,000 kilos was made July 2. Two out of every three rows of stubble were then plowed up and the middle space cultivated, thus leaving the old rows of plants 1.8 meters apart. Again the plants started to grow and were now allowed to blossom and fruit.

The first harvest of 2,120 kilos of calyces was made October 31. The second harvest, November 14, yielded 2,300 kilos, the third, December 11, 1,800 kilos. A small fourth gathering in January was unrecorded. The total yield in round figures was 17 tons of herbage and 6 tons of calyces. If grown for the calyces alone, experiments in Florida and Hawaii indicate that an annual crop of more than 6 tons of "fruit" per hectare may be expected.

The writer had made jelly and flavoring sirups from the herbage in Florida, and while the product obtained was inferior in color to that made from the calyces alone, it was very good, and the wholesale and economical way in which the products could be made from the entire plant as compared with similar products made from the calyces or other fruits led him to favor this mode of utilizing the plant, already of free and vigorous growth and easy culture. Taking into consideration also that sirup and jelly could be made from the tender parts of the plant no less than from the calyces, it was only a step to the inference that the herbage of the plant might also yield wine with proper treatment, and, when in order to obtain reliable figures in regard to the manufacture of products of roselle, raw material was furnished to the Bureau of Science, the writer suggested that an attempt also be made to make wine. The investigations were conducted by Dr. D. S. Pratt of the laboratory of organic chemistry, who gave the result in an interesting article recently published.[1]

The following table of analyses of roselle calyces grown in Florida and the Philippines and of the cranberry is quoted from the paper by Dr. Pratt for comparison.

[1] Philippine Journal of Science (1912), Sec A, No. 3, pp. 201–205.

Analyses of roselle and cranberry.

Constituents.	Florida roselle.	Philippine roselle.	Cranberry.
Water	88.91	82.49	88.53
Solids	11.09	17.51	11.47
Ash	.89	1.26	.25
Marc (insoluble matter)	6.67	7.39	4.60
Acid as malic	2.77	3.31	2.74
Reducing sugar as invert	.33	.82	1.90
Sucrose	.03	.24	.10
Benzoic acid	Absent.	Absent.	Present.

It is interesting to note that the Philippine-grown roselle is considerably superior to that grown in Florida both in acid and sugar content.

The following is quoted verbatim from the same paper:

Roselle owes its pleasant acidity entirely to dextro-malic acid. This is not confined to the calyx alone, but is distributed throughout the plant. The leaves contain about 1.25 per cent and the stems about 0.6 per cent, depending upon their age and location. The stems also contain some coloring matter. It appears from these analyses that both stems and leaves contain sufficient flavoring material to render them suitable for use in connection with the calyces except where it is desired to obtain a brillantly colored jelly or jam.

A comprehensive examination was made of roselle with reference to its adaptability as a source of flavoring sirup and of a beverage resembling wine. In both of these cases it is not essential to obtain a bright red product and the great advantage of utilizing the entire plant made it worth while to experiment on this basis. The cost of the product is lower and the manufacture much more simple than in the other case where each calyx must be gathered separately. Needless to say, a finer-grade product, with better color and flavor, may be obtained from the calyces alone. This is a matter of personal choice. As the procedure is similar in both cases, only that utilizing the entire plant need be given in detail.

ROSELLE SIRUP.

The flavoring sirup may be made according to the following directions, which may be modified to suit the individual taste. The plant should be harvested while still of moderate growth, with tender stems and at least half-matured calyces. While perfectly fresh, chop the entire plant into lengths of about 10 centimeters and pack in a keg or earthenware jar. Metal containers are attacked by the acid, and are not to be used at any stage of the process. Pour in sufficient boiling water to cover the plants, and then cover the keg to exclude dirt and molds as much as possible. Allow this to stand two or three days to extract the soluble material, then filter through muslin or other suitable cloth. This gives a red liquid with a strong acid taste and pleasant fruity smell. Boil this liquid in an enameled dish until it reaches about one-third its original volume and add sucrose to suit the taste. About equal volumes of sugar and concentrated

juice will usually be satisfactory. Continue the boiling with constant stirring until the sugar is completely dissolved, and bottle while hot. If desired, the juice of a lime may be added to each liter of sirup. The resulting sirup has a very attractive taste and makes a refreshing product when added to water, or used as a basis for sherbets, water ices and soda water.

ROSELLE WINE.

Roselle wine may also be made from the entire plant, although here again a product with richer color and better flavor results from using only the calyces. The plant is cut and treated as in making the sirup. After filtering through cloth, the juice is placed in a clean cask previously scalded out with boiling water. For every 4 liters of juice use 1 kilo of sucrose made into a thick sirup with boiling water and poured into the juice. Suspend yeast in warm water, add this to the contents of the keg and mix thoroughly by stirring. The keg should now be carefully covered, or if one with the ends on has been used the bung may be stopped with loose cotton. To obtain a good wine foreign ferments should be excluded. The cask is then put aside and allowed to remain undisturbed during fermentation. Within a week this will near completion. If a sparkling wine is desired, the juice is racked off before fermentation has stopped and stored in bottles with corks securely wired to prevent expulsion. If a still wine is to be made, the bottling is delayed until fermentation has ceased. Age will improve the flavor and bouquet, but the young wine is very attractive in taste and appearance. As made from the entire plant, it has a light reddish color and a sweet refreshing taste.

The still wine made from the herbage analyzed 8.8 per cent alcohol, 13.68 per cent invert sugar, and 1.05 per cent sucrose.

The roselle material employed by Dr. Pratt in his experiments was from the earliest cutting referred to above, and for this reason the young plants had a few partly grown calyces; the subsequent cuttings carried no calyces and in fact repeated cuttings during the summer could never have any for the reason that the plant does not blossom until September and October. From his experience with jelly and sirup of the plant the writer does not believe that the presence of calyces is essential; however, when present as part of the raw material, they tend to improve the color of the product.

It is, of course, not anticipated that roselle wine will ever compete with the better classes of wine, but it would undoubtedly serve a useful purpose as a cheap and good wine for those who consume the poisonous adulterated article that is now sold in such large quantities.

About 100 kilos of herbage and 75 kilos of sugar make 300 liters of wine, while an equal amount of herbage furnishes approximately 200 liters of sirup, depending upon the quality of the herbage at the time of the cutting. If the material is tender

and succulent less is required to make a given amount of the finished product than if it is overripe and fibrous.

According to Mr. Higgins of the Hawaii Agricultural Experiment Station, about 4 kilos of calyces and 1.8 kilos of sugar are required to make 1 dozen 6-ounce jars of jelly.

In considering the possible profits in growing roselle and manufacturing it into various products, the price of local labor should of course be taken into consideration in connection with the figures quoted above. It should also be remembered that well-flavored and attractive though the products may be they are at present practically unknown in the world's markets and that the expense of judicious advertising would probably be necessary in order to introduce them.

During 1912 several new varieties of roselle were introduced into the Philippines and tested at the Lamao and Singalong experiment stations. Only one of these has approached in quality and yield the previously introduced varieties "Victor" and "Rico." The Rico showed more vigor and resistance than any other kind to a fungus that more or less seriously injured the other varieties.

Two varieties imported from the Gold Coast, West Africa, are remarkably distinct from any other variety that has hitherto come to the attention of the writer. One is a red form and the other intermediate between the green and red types; both are of remarkably vigorous growth, of upright habit, not bushy, and frequently exceeding 3.5 meters in height. The calyces are small, closely fitting the seedpod and thickly covered with short stiff bristles. Both these varieties are useless from a culinary point of view; they may, however, be of value for their fiber.

THE COCONUT LEAF-MINER BEETLE.

(*Promecotheca cumingii* Baly.)

By CHARLES R. JONES, *Entomologist.*

The coconut tree (*Cocos nucifera* L.) is attacked by a comparatively small number of insects but the damage received from the ravages of these insects is rather large as compared with the insect injury to some of the other crops of the Philippines. The coconut has several insect enemies that feed extensively upon the trunk and leaves and in seasons favorable to insect development the increased damage means considerable loss to the grower.

The most comprehensive work on coconut insects of the Philippines was published by the Bureau of Science,[1] treating them as two classes, i. e., those that attack the trunk and those that attack the leaves. The coconut number of the PHILIPPINE AGRICULTURAL REVIEW [2] also contains a chapter on "Insect Enemies of the Coconut." The department of agriculture of New South Wales [3] and the board of agriculture of Trinidad and Tobago [4] have each issued a publication which treats extensively of coconut insects, but none of the papers named records the abovementioned species which in both the larval and adult stages feeds upon the leaves of the young coconut. As yet the writer has not found the old palms to be attacked by this pest, and in all probability they are very seldom injured by this insect.

The object of the present paper is to give briefly the life history and habits of this insect with methods for its control.

This beetle belongs to the subfamily *Hispidæ,* of the Chrysomelidæ family, which contains our worst leaf-eating beetles, and is distributed generally throughout these Islands. There is but little doubt that it, or representatives of this family,

[1] The Principal Insects Attacking the Coconut Palm, Philippine Journal of Science, 1906, Vol. I, Nos. 2 and 3.

[2] Insect Enemies of Coconuts, Philippine Agricultural Review (1912), Vol. V, No. 5, 254–261, 5 pls.

[3] Pests and Diseases of the Coconut Palm, Department of Agriculture, New South Wales, Science Bulletin (1912), No. 2, 1–47, Figs. 10, pls. VII.

[4] Preliminary Notes on Some Insects Affecting the Coconut Palm, Board of Agriculture, Trinidad and Tobago (1911), Circular 5, 1–26, pls. III.

occur in all coconut-growing countries; in fact, Mr. W. W. Froggott [5] reports a representative of this subfamily as being the most serious coconut pest of the Solomon Islands.

LIFE HISTORY.

Egg.—The egg (fig. 2, *a*) of *Promecotheca cumingii* is deposited singly on the under side of the leaflets and generally on the lower leaves of the young palms. The beetle eats a small hole through the lower epidermis of the leaf, leaving the edges very rough. The egg is then inserted in this hole, and cemented into place with a yellowish glutinous secretion which turns

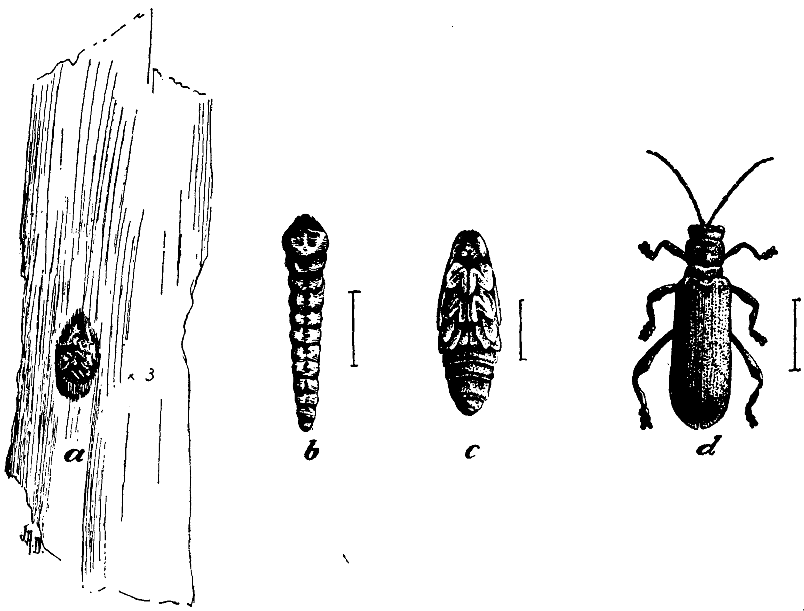


Fig. 2. Coconut leaf-miner (*Promecotheca cumingii* Baly). (*a*) Egg on leaflet; (*b*) larva; (*c*) pupa; (*d*) adult.

dark brown upon hardening, and resembles the dried leaf tissue. In some cases the adult was observed, after the egg had been cemented into place, to pat it with her front feet, but usually, after resting a few seconds over the egg, she moves away and resumes feeding.

The eggs are flat, semielliptical, brownish bodies shaped somewhat like a pumpkin seed; the outer surface or covering is very rough, and the eggs are very easily broken when this protective substance is removed. Their length is 1.5 milli-

[5] Science Bulletin No. 2, New South Wales, 24, 26.

meters; width, 1 millimeter; thickness, 0.3 millimeter. The period of incubation (of 286 eggs) averaged 13.5 days, the maximum being fifteen and the minimum thirteen days.

Larva.—Upon hatching, the larvæ (fig. 2, *b*) eat their way through the egg wall and directly into the tissue of the leaflet where they spend the entire larval and pupal stages and are protected to some extent by the lower and upper epidermis of the leaflet. They are fleshy footless grubs and average about 1.2 millimeters in length when newly hatched. The head is larger than the following segment, wedge-shaped, shiny brown, translucent and has rounded sides; the mandibles are black and can be drawn under the labrum. Two brownish lines form an X on the back of the head. Two whitish bodies extending under the head near apex give the appearance of an arrow head. These markings are absent in latter stages. In older larvæ the head is slightly smaller than the following segment; body yellowish cream color, semicylindrical, tapering from segments 1 to 11, and anal segment being about one-half the size of segment 1. Segment 1 depressed anteriorly, segments 1 to 11 protruded into tubercles on both sides which give rise to setæ of six hairs each.

Average length of full-grown larvæ, 9.54 millimeters; average width of head cast, 1.54 millimeters. The average time required in the larval stage is 32 days. Twenty-eight of these are spent in feeding and developing and four days are spent without feeding in which time the larva changes into a pupa. During the development of the larva it feeds upon the parenchyma of the coconut leaf and at all times, except when molting, it can be found at the end of the chamber farthest from the egg. The larva burrows in one direction only, the old egg shell marking the starting point. When molting and when changing into a pupa it recedes to the center of its chamber. A characteristic habit of the larvæ is the depositing of the excrement in two rows, one on either side of the excavated chamber.

In studying this insect, adults were placed in gauze bags which were tied over the leaflets of the palms. These insects were removed daily to fresh leaves and the leaflets containing the eggs were tagged but still kept in the gauze sacks to keep out possible parasites. Daily observations were made on these eggs for hatching and the larvæ were examined every two days for molts.

After opening the larval chamber the leaf curled and dried and the larva in most cases died, or its development was greatly retarded; therefore it was necessary to take four larvæ of the

same age for each day's observations. In no case were more than two molts observed; the exact number of molts has not been definitely established, owing to the difficulty in observing this insect.

Pupa.—After the larva is full-grown, as stated above, it retires to the center of the chamber and here without forming any pupal cell, undergoes the transformation into pupa and adult. The average time occupied in the pupal stage is 7.3 days, the maximum period noted being 12 and the minimum 5 days.

The pupa (fig. 2, *c*) is of a chrome-orange or burnt-sienna color; hairy; head smaller than thorax; eyes black; mandibles brown; the anterior tarsi held together. There are two rows of black transverse spines on each segment, the anterior row consisting of six spines. The average width is 1.6, and the length 8.1 millimeters.

Adult.—The beetles (fig. 2, *d*) vary from 7.5 to 10 millimeters in length, exclusive of the antennæ and from 1.6 to 2 millimeters in width. The thorax is much narrower than the slender body. General color brown ochre, head small, eyes and mandibles black, elytra finely punctate in parallel furrows. Antennæ 11 jointed, tarsi broad and flat, one larger spine on inner side of each femur with a corresponding depression on the tibia. The body is pilose.

The beetles are sluggish and do not fly readily upon being disturbed. They rest by clinging lightly to the under side of the leaf with the antennæ extended forward close to the leaf. They crawl about promiscuously on the leaves of the young coconut and feed extensively upon the tissues between the veins of the leaflets. The injury has the appearance of a slight cut but does not entirely penetrate the leaf (Plate VII, *a*).

The damage done by the larva is greater than that by the adult, as a single larva will excavate a place in the leaf from 12 to 16 millimeters long and 1½ to 3 millimeters wide (Plate VII, *b*). The tissue attacked soon dies and becomes brown, and in badly infested areas the numerous dead leaflets give the palm the appearance of being unhealthy or half dead; where the trees are used for decoration this effect is very displeasing. The palm is also injured by the loss of these leaflets.

LIFE HISTORY SUMMARY.

The eggs are inserted by the female beetles just beneath the epidermis of the leaf. They are deposited singly, and hatch in from 13 to 15 days. The period of incubation varies but little. The larvæ upon hatching enter the parenchyma of the

leaf and here spend the entire larval period, which is about 32 days. They do not form any pupal cell but pupate in the middle of the excavated chamber formed by feeding. The average length of the pupal stage is 7.5 days. The adult after emergence remains from two to four days within the food chamber, before it bursts the epidermis of the leaf and escapes.

CONTROL.

As is the case with many other insects, the coconut leaf-miner undoubtedly has many enemies, both predaceous and parasitic. Two species of *Hymenopterous* parasites of the family Chalcididæ have been bred in great numbers, one from the egg and one from the larva and pupa. These have not yet been identified. In fact, it is probable that these parasites keep this beetle in check, and were it not for them, the leaf-miner would be a most serious pest to the coconut industry.

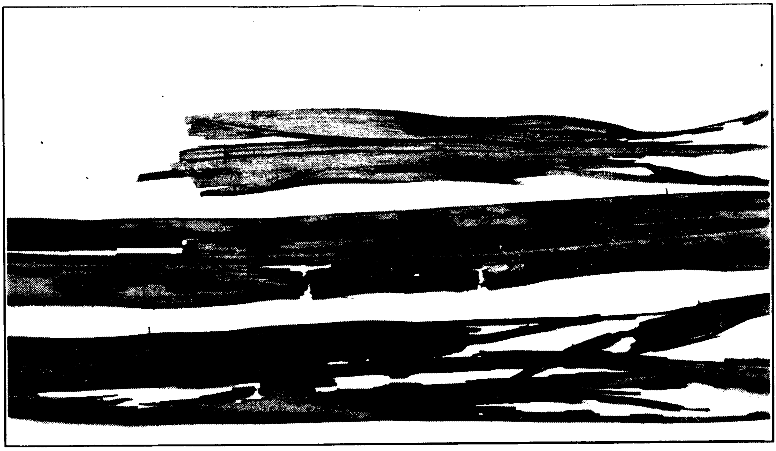
Observations have shown that a little over 44 per cent of the larvæ and pupæ are parasitized by this Chalcidid while egg parasitization averages about 5 per cent. From these two parasites alone the total percentage of mortality is about 50 per cent.

The following table gives the results of the examination of 100 leaflets taken from infested palms on August 3, 1910:

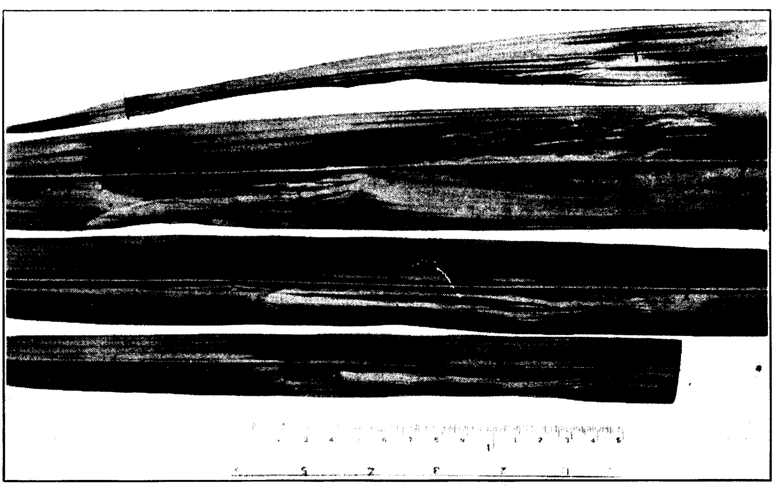
Leaflets examined.	Eggs.	Larvæ and pupæ.	
		Alive.	Dead.
10	23	20	18
10	41	30	11
10	38	23	23
10	25	29	22
10	27	33	35
10	29	21	16
10	30	17	12
10	21	15	6
10	24	15	11
10	13	14	22
100	296	217	176

NOTE.—Leaves taken promiscuously from different palms. No account was kept of previously infested areas, the only record was of places that contained evidences of the presence of the leaf-miner. Percentage of larvæ parasitized, 44.7 Three leaves found free from infestation.

As the eggs, larvæ, and pupæ of the leaf-miner are protected to a greater or less extent within the leaf tissue, hydrocyanic-acid gas, used as a fumigant, would be the only effective insecticide. This method would be recommended only in extreme cases where infestation is very heavy. As the beetles are not very active and are almost invariably on the lower leaves of



(*a*) Leaflets injured by adults.



(*b*) Leaflets injured by larvæ.

Coconut leaflets injured by *Promecotheca cumingii* Baly.

the coconut palms, they can be readily controlled. The infested leaflets are readily recognized and may be easily removed and burned, thus destroying the eggs, larvæ, and pupæ.

Hand picking of the adults and removing of infested leaflets is the simplest remedy, and since it requires no skill, even children can readily do the work.

The above operations if practiced in the infested young groves would be an inexpensive and effective method of control.

THE FIFTH ANNUAL MEETING OF THE PHILIPPINE VETERINARY MEDICAL ASSOCIATION.

By Dr. ALVIN BROERMAN, *Secretary-treasurer.*

The fifth annual meeting of the Philippine Veterinary Medical Association was held in the Young Men's Christian Association Building, Manila, on Friday, February 7, 1913.

The president, Dr. Joseph R. Jefferis, veterinarian, Seventh Cavalry, U. S. Army, called the meeting to order at 9.30 a. m. As the minutes of the last meeting had already been published, it was not considered necessary to have them read before the association.

A short address of welcome was delivered by the Hon. Newton W. Gilbert, Vice-Governor and Secretary of Public Instruction of the Philippine Islands, in which he enumerated the difficulties that the veterinarians in the Bureau of Agriculture are having in enforcing an efficient quarantine against rinderpest throughout the Archipelago. He also stated that the veterinarians occupy a very delicate position which often requires a large amount of diplomacy and his earnest desire is that they try their utmost to gain the confidence of the Filipino people. Dr. Jefferis responded.

Dr. C. H. Decker read a paper on rinderpest in the Amburayan Valley and Dr. J. D. Reardon a paper on rinderpest quarantine in the Province of La Union. They cited their experiences and some of the interesting results obtained in eradicating this disease.

Mr. M. B. Mitzmain, veterinary entomologist, Bureau of Agriculture, read a paper on the entomological factors concerned in the measures required for the control of surra. Mr. Mitzmain is working on the transmission of surra at the Alabang research laboratory and stated that he has found *Tabanus striatus* to be an agent in the transmission of the trypanosomes of surra. This paper stimulated a lively discussion on the various phases of the disease.

Dr. R. W. Newcomb read a paper entitled "Kidney-worm infestation of swine as shown post-mortem at the Manila matadero." The worm (*Stephanurus dentatus*) was found by Dr. Newcomb in 50 per cent of the animals slaughtered.

Dr. W. H. Boynton, pathologist, Bureau of Agriculture, gave a short lecture on the diagnosis of rinderpest by blood examination, illustrating his talk by charts. Dr. Boynton also stated he has found that leeches, after sucking blood, carry the infection for more than three days.

Dr. C. H. Schultz, who read an instructive paper entitled "Observations on the diagnosis of glanders," is also working at the veterinary research laboratory at Alabang.

A report by Dr. C. G. Thomson on the rinderpest campaign on the Island of Panay was read by Dr. Archibald R. Ward, chief veterinarian, Bureau of Agriculture. This gave in detail the methods employed in that district.

Dr. T. T. Hartman prepared a paper on the quarantine and tie-up in the northern district of Iloilo Province. It was impossible for Dr. Hartman to attend the meeting and the paper was read by the secretary.

The meeting then went into business session and the following officers were elected: President, Dr. F. C. Gearhart, chief of the division of animal husbandry, Bureau of Agriculture; vice-president, Dr. A. G. Donovan, veterinarian, First Field Artillery, U. S. Army; secretary-treasurer, Dr. R. W. Newcomb.

It was decided to give a banquet at the Army and Navy Club on the same evening.

The following members of the association were present at the meeting: Drs. A. R. Ward, Joseph Jefferis, A. G. Donovan, A. S. Shealy, Stanton Youngberg, C. H. Leavitt, Lyman Bishop, W. W. Richards, R. W. Newcomb, F. W. Wood, C. H. Schultz, W. H. Boynton, J. A. Thompson, D. W. Shaffer, W. J. Palmer, A. H. Julien, C. H. Decker, J. D. Reardon, W. A. Korb, J. R. Burns, H. F. Hungerford, H. F. Kern, L. W. Fisher, A. M. Meade, J. L. Gross, W. L. Davis, W. K. Howard, W. A. Kliphardt, C. C. Middleton, D. F. Coyner, Victor Buencamino, W. A. Curtis, F. C. Gearhart, and Alvin Broerman. Six visitors attended the meeting.

The meeting was adjourned to convene at the call of the president.

118167——3

THE RECENT CAMPAIGN AGAINST RINDERPEST ON THE ISLAND OF PANAY.[1]

By C. G. THOMSON, *Supervising Veterinarian.*

In accordance with travel order dated June 10, 1912, I sailed from Manila June 15, arrived at Iloilo June 17, and immediately took charge of the campaign, relieving Dr. F. W. Wood.

Drs. Elliott, Hartman, Ladson, and Palmer have been associated with me in this work, with an average of about 10 American and about 35 Filipino live-stock inspectors.

At the time of my arrival the following forces had been assembled and distributed:

(*a*) Philippine Constabulary: One company, distributed through La Paz.

(*b*) Philippine Scouts: Twenty-fourth Company (Captain Neisser); Twenty-first Company (Lieutenant Strauhm); Thirteenth Company (Captain McElldery); Seventh Company (Lieutenant Vaschon). One-half of the Tenth Company (Lieutenant Rimmer), and all the Forty-ninth Company (Captain Spears), were later made available, and relieved the Constabulary, who were withdrawn from rinderpest duty and returned to barracks. During the last six weeks of the campaign the Seventh Company, which had been withdrawn in August for post duty, was returned to rinderpest service for about a month.

Maj. Hanson Ely organized the Scout rinderpest service, but was ordered to the United States in August and relieved by Maj. Alvord V. P. Anderson, who remained in command of the troops until the work was completed.

The plan of campaign differed but slightly from other Scout campaigns of last year. The most significant departure from former methods lay in the abolishing of intermunicipal quarantines, the infected or suspected barrios alone being guarded against exit of susceptible animals. The infection was so widely scattered through Iloilo and Capiz Provinces, and the physical features of the territory to be covered were such that it was considered inadvisable to attempt at the outset a progressive search of all territory. Instead, a Bureau corps and detach-

[1] Submitted February 4, 1913.

ments of troops were maintained in all known infected areas, and from these centers the surrounding country was worked. Subsequently, as infection subsided, it was possible to concentrate the forces and to effectively cover all of the inhabited portions of Iloilo and Capiz Provinces. The troops were not used in Antique, as the character of its terrain is such as to permit of handling more economically by Bureau forces alone or with Constabulary aid if it becomes necessary.

Census work was pursued as usual by Bureau employees, who completed animal lists for nearly all the towns occupied. The Scouts also did some independent census work. The usual discrepancies with municipal lists were seldom noted as the municipal census averaged only about 10 per cent below that made by the Bureau forces. The municipal officials of Iloilo Province are in unusually close touch with animal conditions.

A request for the use of a small launch was submitted early in the campaign for the purpose of making occasional patrols of the straits, as well as for service in transportation of men and supplies, but no such launch was available. The fear that infection would be carried to Guimaras and Negros proved without foundation, as to the best of my knowledge rinderpest does not exist in either island. Credit for the escape of Negros belongs to my predecessors, who developed an effective port supervision for outgoing animals through utilization of the efficient local customs service. Throughout the campaign susceptible carabaos were held under observation in Iloilo for twenty days, and cattle ten days, pending extraprovincial shipment. Since the apparent eradication of rinderpest from Iloilo Province, these periods of observation for carabaos and cattle have been reduced to ten and five days, respectively, and shipments will be thus handled until the removal of quarantine restrictions imposed by the Honorable the Secretary of Public Instruction.

Every effort was made to acquaint the people with the potential gravity of the situation, to enlist their sympathy and coöperation and to direct their efforts correctly. This was attempted by conferences with influential men, by obtaining the support of the local press, by means of explanatory circulars sent to each planter in the two provinces, etc.

The lack of experienced American inspectors interfered from the outset and unquestionably was costly to the Bureau. No other single factor so seriously handicapped the veterinarians in their work. The American inspectors now on duty in Panay are very satisfactory employees.

There was less delay in organizing a suitable Filipino corps, as several experienced Filipino inspectors were already on the ground and it was not difficult to build up a satisfactory personnel around them. Our present Filipino corps is the most efficient I have known.

The provincial government of Capiz provided 10 Filipino inspectors and is still maintaining this number for service against foot-and-mouth disease. The Province of Iloilo early in the Scout campaign provided 10 men, but owing to lack of funds was obliged to reduce the force to 5 men in October and to discharge these at the end of December.

The work was trying physically to the men, being inaugurated at the beginning of the rainy season. The infected country was rugged and hard to cover, good roads were short and few in number and the trails muddy and crossed by numerous unbridged streams. Owing to the scarcity of ponies on this island most of the traveling was necessarily performed on foot.

As the campaign was initiated at the beginning of the plowing season, there was some complaint against the system of tying up carabaos in infected barrios, but it was possible to issue work passes in all districts in ample time to permit necessary seedbed work, and later for more extensive preparations of fields.

The stimulus afforded to plowing activities in other campaigns was in evidence again in this. Iloilo Province increased her normal rice acreage by 55 per cent, and Capiz Province by 40 per cent. It is regrettable that subsequent losses by typhoons and insect pests materially reduced these anticipated harvests.

A most favorable feature of this campaign was the dispatch with which the quarantine force was made available for duty in Panay. The infection was so scattered that, had it been impossible to throw troops and veterinary corps into the island immediately, it is probable that a most costly outbreak would have developed. It is especially fortunate that of the troops detailed for this district several companies had seen previous rinderpest service in Cebu, Oriental Negros, and Siquijor, were placed in the field immediately by Major Ely, and were able to operate effectively from the outset.

Worthy of note is the almost perfect execution over a wide area of the often attempted "isolation-work" quarantine established in the Pototan district by Dr. T. T. Hartman. He obtained a complete segregation of carabaos by persuading owners to tie each animal on the plot of land the animal was to plow,

building a cheap cover for shade during the midday, and usually securing water by digging a shallow well on the spot. This was accomplished throughout that district. It is a perfect form of quarantine, checks rinderpest automatically, and yet does not interfere with plowing.

Following the completion of the work in Capiz and Iloilo Provinces and the withdrawal of troops from local rinderpest duty in November, Dr. W. J. Palmer, with 3 American and 9 Filipino inspectors was stationed in southern Antique; they have since been conducting a progressive campaign northward, and are now approaching the end of the work. Simultaneously, Dr. H. H. Ladson, with 1 American inspector and 10 provincial-paid Filipinos, has been operating against foot-and-mouth disease, which has obtained a serious hold in Capiz Province. In Iloilo Province Mr. W. H. Brightman with 6 Bureau Filipino inspectors has eradicated the rinderpest and foot-and-mouth disease which developed in Guimbal, and later searched the contiguous territory. Mr. James McIntosh is stationed in Occidental Negros to keep in touch with conditions there. Following the completion of the Antique project I purpose detailing one veterinarian and several inspectors in Negros, with the object of making a reasonably close search of that province for animal disease.

In addition to rinderpest, surra, and foot-and-mouth disease, sarcoptic mange of carabao and infectious lymphangitis have also been encountered in the field during the period with which this report deals, June 1 to December 31, 1912.

During the six months from July to December there was a total of 24 municipalities infected, all developing cases of rinderpest which were verified by post-mortem examination by Bureau employees. These infections were widespread, being distributed as follows: Capiz Province—Lizo, Taft, Malinao, Banga, Panay, Capiz, Panitan, Pontevedra, and Dao; Iloilo Province—Guimbal, Oton, Arevalo, Iloilo, Jaro, Santa Barbara, Pototan, Dumangas, Barotac Nuevo, and Passi; Antique Province—Valderrama, Pandan, San Josê, and Sibalom.

A glance at the map of Panay will show the extent of the area involved.

The records at hand show a total of 130 animals attacked by rinderpest, 99 deaths and 31 recoveries, a mortality of 76 per cent. These figures are, of course, exclusive of the imported animals handled at the La Paz quarantine station.

The origin of infection is a debatable question. It is reasonably certain that the majority of towns were infected through

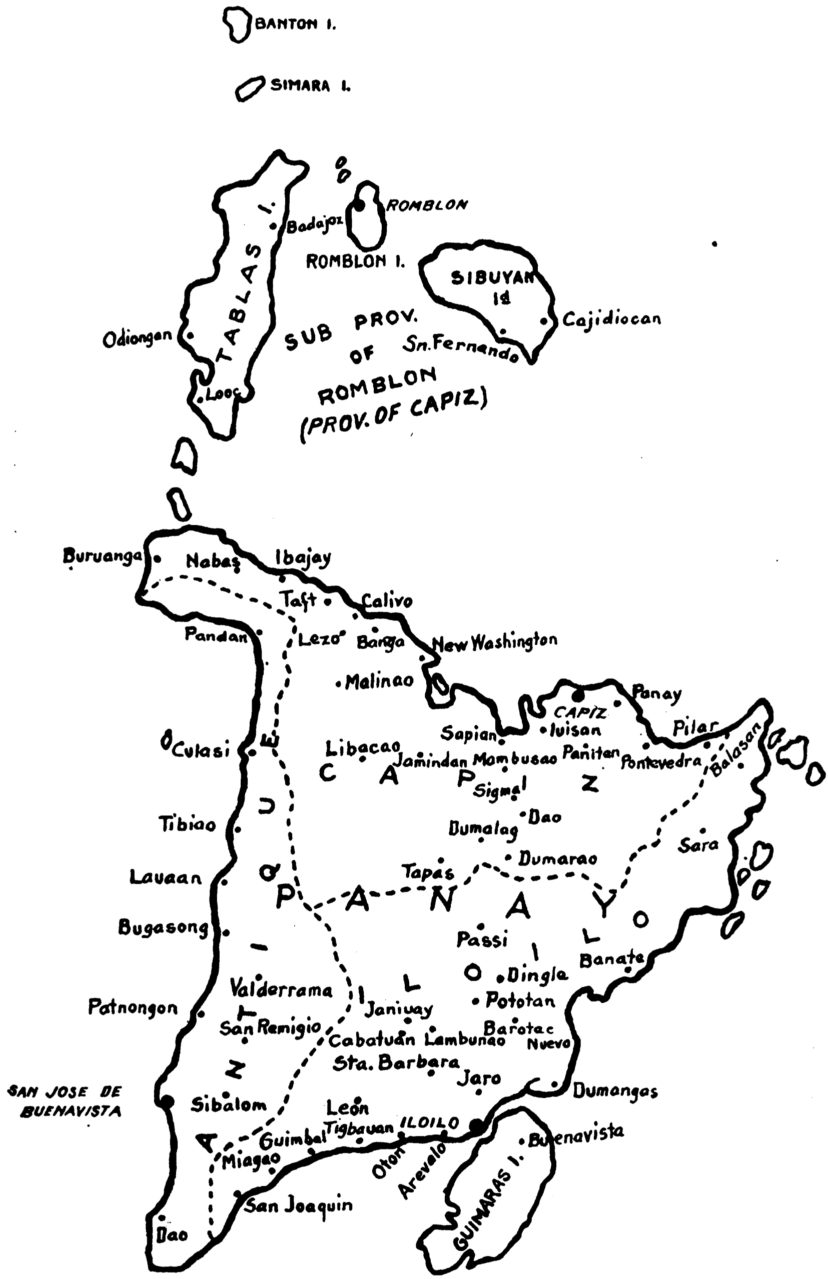


Fig. 3. Map of Panay.

shipments of carabaos from the La Paz corrals. Subsequently, during the period of simultaneous inoculation when over a thousand animals were handled in improvised corrals, infection probably escaped into the immediate surrounding area. However, it is difficult to account for the contemporaneous appearance of the disease in isolated towns, such as Pandan, except by the assumption that rinderpest has lurked in remote districts since a time prior to the arrival of the infected Indo-Chinese carabaos. This assumption is justified by the fact that the Bureau had not been able heretofore to maintain a sufficient force in Panay to permit of thorough searching. The assumption of previous infection may also serve to throw light on the varying virulence of the disease in different localities, which reached 100 per cent in some areas and only 10 per cent in others—this among animals of similar breed and approximately like age.

The La Paz center of infection and the history of the distributions of animals from there accounts for the disease along and near the railway and the traveled highways. However, one must adopt the previous infection hypothesis for certain other districts such as Pandan, Valderrama, and the mountain barrios of Guimbal, which are difficult of access and are sources of supply rather than animal markets.

The infection of Iloilo, the rapid spread of rinderpest over so large a territory, and its early recognition by the public as a serious menace to the prosperity of Panay and Negros, aroused a general interest and a degree of coöperation new in my experience. Substantial assistance was rendered the Bureau by various organizations and persons.

Especially deep appreciation is felt for the assistance rendered by several local offices. The Philippine Railway Company, with notable public spirit, furnished free transportation for employees and all materials used in the rinderpest campaign; when the need for inspectors was especially pressing they loaned Mr. Renner to the Bureau for field work. Governor Montinola of Iloilo and treasurer Gracey of Capiz took a keen interest in the work and were especially helpful in tiding over the unpleasant period when the planters feared loss of crops through quarantine restrictions. The attitude of the local press was gratifying throughout.

The Philippine Constabulary assisted in many ways. Detachments were made available for quarantine service whenever requested; circulars of instruction were given to each soldier, outlining briefly the simple facts concerning rinderpest, so that in patroling they could intelligently gather information relative

to that disease and act thereon. As in their routine patrols they regularly cover every place on the island, their utilization was a considerable asset. The Constabulary also rendered aid of a confidential nature.

The Philippine Scouts were, as in other similar campaigns, of inestimable value. Without their assistance or that of a similar arm, little could have been accomplished.

Following is a chart showing, by weeks, the recorded deaths, etc., during the period from June 9 to December 28, 1912:

Week ending—	Provinces infected.	Towns infected.	Barrios infected.	New cases.	Deaths.
1912.					
June 9	Iloilo	5	16	13	10
15	do	8	15	15	6
22	do	7	20	6	12
29	Iloilo and Capiz	7	10	4	8
July 6	do	10	17	9	4
13	do	10	17	10	2
20	Iloilo and Antique	8	12	10	6
27	Iloilo	6	9	1	5
Aug. 3	do	8	10	8	7
10	Iloilo and Antique	8	11	4	1
17	do	7	10	3	2
24	do	7	10	2	4
31	Iloilo, Antique, and Capiz	8	13	8	5
Sep. 7	do	5	10	7	3
14	Antique and Capiz	8	13	8	4
21	do	8	14	4	5
28	Capiz	7	13	1	0
Oct. 5	do	6	12	1	0
12	do	5	11	0	1
19	Antique and Capiz	3	3	4	4
26	do	3	3	0	0
Nov. 2	Capiz (no report from Antique)	1	1	1	1
9	Antique and Capiz	2	2	0	0
16	Capiz (no report from Antique)	1	1	0	0
23	Capiz	1	1	0	0
30		0	0	0	0
Dec. 7	Iloilo and Antique	3	3	7	7
14	do	3	4	2	1
21	do	3	5	2	1
28	do	3	5	0	0
Total				130	99

CURRENT NOTES—MAY.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

MANCHURIAN BEANS.

It is almost inconceivable that in the brief period during which European commerce has taken note of North China beans there should have been built up a trade amounting to no less than from 60 to 75 million pesos per annum. In a country by no means famous for its soil richness nor its transportation facilities there has been established a first-class industry in which the profits are very large in proportion to the capital employed. It just happened that the climate and the soil were unusually well adapted to the soya and broadbean culture.

Gauged largely by the demand for oil and bean cake in Europe and the amount of available cheap freight transportation, this bean crop will increase and probably more and more influence the Philippine copra and coconut-oil trade. Strangely enough this legume crop, which one would think could have no possible connection with palm nuts, does throw a very vast amount of cheap oil into the world's markets and the cake from the oil presses does compete with poonac, or copra cake, as a cattle feed. Briefly then, good weather in Manchuria or better commercial outlets for the bean crop of that country affect the profits of the Philippine coconut grower almost immediately.

BURMA CROPS.

Peanuts are slowly but surely coming to the front in Burma according to consular reports. The area in this crop now under cultivation in that country is nearly 70 thousand hectares and the present crop is estimated at some 67 thousand tons. This crop also affects the value of copra oil.

The rice crop of Burma is approximately 2½ million tons. The area under cultivation is gradually increasing and now amounts to considerably over 3 million hectares. The present reported area cultivated to rice in the Philippines is 1,120,000 hectares.

AUSTRALIAN MEATS.

The experiment of exporting meat from Australia to San Francisco and Hawaii is now being made. When we remember the wonderful facilities both in the way of very cheap production and in the tremendous advantages of modern systems of shipboard refrigeration, it is to be expected that the agricultural districts of the United States would better go in for high crop yields and buy their meats with a (small) portion of the profits therefrom.

COCONUT AND COCOA.

The world is consuming hundreds of tons of coconut "butter" daily. We are also using one way and another very large amounts of cocoa butter, which is translated cacao tallow. This tallow, made as a by-product in chocolate manufacture, is a very highly nutritious food in itself and a sort of flavoring "filler" for many sorts of confectionery, etc. It is also extensively used by the medical profession.

While formerly it was considered of not much value, largely on account of its use being hardly understood, it is now worth more than the product itself, something like ₱2 a kilo. Unfortunately the British, and to some extent the American, manufacturers persist in using this old-fashioned and more or less execrable word "cocoa" instead of cacao. Not only in resemblance of words, then, but actually in commerce, do these two comparatively new vegetable "butters" stand as rivals.

VENEZUELAN COCONUT FACTORIES.

We learn from the Daily Consular and Trade Reports that a new coconut plant is being established near Cumaná to handle direct coconut products. It is believed that 30 to 40 thousand nuts per day can be secured in the neighborhood, which ought to run the plant night and day the year round. Cooking oils, butters, etc., are to be manufactured and, of course, the coir is to be saved, and possibly alcohol will also be produced from the tuba.

THE LIME INDUSTRY.

In the little British colony of Dominica, in the West Indies (an island about the size of Busuanga or a little larger than Marinduque) there is produced no less than 700 thousand pesos worth of lime products every year. It must not be understood, however, that these limes are all consumed in the fresh state

nor exported as fruits; the calico manufacturers really support the lime industry, since it is the citrate of lime, a crude chemical compound made from concentrated lime juice, which is so necessary to "set" the dyes of cotton cloths.

Of course, by no means all of this small island is planted with limes (there being really more hectares under cacao than under limes), yet the total product for the island is estimated at something like 360 thousand barrels (fresh fruits) per annum.

There is no good reason why many districts of the Philippines which are producing practically nothing at present could not be made to turn out as much or more of lime products than does Dominica. A crude-process lime-juice factory is not a very pleasant place to look upon nor to smell, but with modern methods and ordinary cleanliness there is not only big profits but a lot of interesting work to be had from such an institution.

MEXICAN COCONUTS.

Because of the growing world-wide interest in coconuts, or rather copra, even the Pacific coast of Mexico is now coming to see that there is no time to be lost in starting plantations for this industry. Not only in the coast-plain belt (rather narrow on the "back side" of that Republic), but also back in the interior in the "dry country" where droughts are severe, copra is produced in large quantities and is so cheap that it can be carried over rough trails on burros (about 140 kilos per animal being the load) and sold at less than ₱0.14 per kilo. It is even estimated that one average bearing tree will yield ₱5 worth of copra with little cultivation, and about three times that amount when properly handled.

ANIMAL HUSBANDRY IN MEXICO.

Notwithstanding the serious political disturbances of the Mexican Republic during the past two years, the increasing production of horses and mules is much in evidence. It is stated that good "home-grown" mules may now be raised in Mexico at from ₱5 to ₱8 each; these mules readily bring on the market from ₱40 to ₱120, a profit larger than can be obtained in almost any other business in the world. Horses are, of course, more expensive but are raised in large numbers and can be bought for ₱100 and upward.

It is worthy of note that the interest in hinny raising which was apparent some three to five years ago has almost entirely disappeared; this is difficult to understand since it would

obviously be much easier and better for the average stock raiser to keep a good stallion at a central breeding stable in districts where ass mares are cheap and plentiful than to try to keep a large expensive stud of American mares for breeding to a probably second or third class "jack."

NOTES BY C. R. JONES, Entomologist.

BAGWORMS.

A very spectacular sight occurred in Manila during February, which caused no little comment. The "caballero" trees (*Delonix regia*) in various parts of the city had been rather severely attacked by several species of bagworms. It is the habit of the larvæ of the bagworm to form a bag or protective case of leaves or small sticks held together by silken threads, and while still in the trees are unnoticed by the general public. After completely defoliating the trees and upon reaching maturity, and prior to leaving the trees in search of new food or a suitable place to pupate, they suspended themselves from the branches by a tiny, almost invisible silk thread and for several days could be seen floating in the breeze. Some of the defoliated trees along Malecon Drive contained hundreds of these suspended insects at a time, each in its protective case of leaves. Frequent inquiries were made of this Bureau as to why the leaves of these trees were suspended in the air.

ANTS INJURIOUS TO OKRA.

A species of red ants (*Solenopsis geminata*) has been noted to be very injurious to okra. They attack the young fruit buds just before and after blooming, completely destroying the calyx and corolla, and in some cases have done considerable damage by eating into the seed pods. Pods attacked by these ants are generally stunted and very irregular in shape. As these ants are very numerous on the okra plants they have not only become injurious to the plant but their sting is very annoying to the person gathering this vegetable.

The social habit of these ants facilitates their control, to effectuate which it is only necessary to locate the nest, which is always in the immediate vicinity of the attacks, and to apply a small quantity of petroleum, which quickly drives them away.

TOBACCO INSECTS.

In a recent communication the municipal president of San Jacinto, Pangasinan, reported the appearance of insects attacking

the tobacco within that municipality. Some specimens were submitted to this office together with infested stems. The insects contained in the tobacco were of the order Lepidoptera, but as they were in the larval and pupal stages their identification was impossible. However, in all probability this insect is closely allied to the tobacco splitworm (*Phthorimaea operculella* Zell.), but the character of the injury is slightly different from that caused by the latter.

The above-named species attacks the stem and parenchyma of the leaf and is at times found crawling over and feeding upon the outer tissue of the leaves. From the general appearance of the specimens submitted it would seem that this insect spends it entire life cycle, with the exception of the adult stage, within the stem of the plant. The splitworm may be controlled, to a certain extent, by the use of insecticidal sprays; the insect reported from San Jacinto, however, seems to spend the entire life cycle within the plant tissue. A rotation of crops would be necessary for the control of the latter insect. A package of insects, also submitted by this president and reported as being injurious to tobacco, contained specimens of a tree cricket (family Gryllidæ), a long-horned grasshopper (family Locustidæ), and larvæ of *Prodenia litura* Fabr. The two first-mentioned insects, though from general appearance very conspicuous, do very little damage to growing tobacco, and they would have to appear in large numbers before they would necessitate any radical means of control. The larvæ of the last-named species feed ravenously on all solanaceous plants and is at times a serious pest to growing tobacco; when appearing in sufficient numbers they may be easily controlled by a light application of paris green or arsenate of lead.

Another very effective means of controlling this pest is hand-picking shortly after the larvæ have hatched. The eggs of this insect are laid in clusters of from 300 to 500 each. The egg masses are covered with buff-colored hairs which are derived from the anal tufts of the moth. Upon hatching, the larvæ remain clustered from three to five days, feeding upon the epidermis of the leaf and skeletonizing it; thus infested leaves are very readily located. By simply removing and destroying the egg masses or newly hatched larvæ, this pest may be readily controlled.

MECHANICAL INSECT CONTROL.

The losses caused by insects to various crops, garden truck, and shade trees is far in excess of that supposed by the general

observer. This loss is steadily on the increase instead of on the decrease, due to the fact that agricultural areas are becoming larger, thus destroying natural food plants of insects and introducing a new environment. Insects that were formerly unknown as a pest may become noxious on closely allied cultivated plants due to the change in environment and the destruction of the normal host plant; thus we see that the injuries caused by insects and the loss in money value are gradually increasing.

There are several factors which come under the head of natural agencies regarding the control of insects; these may be classed as climatic conditions, and predatory and parasitic enemies. In the control of an insect pest, we should, in addition to these combined natural agencies, apply our artificial means in an energetic, systematical, and coöperative campaign so far as possible. The combined efforts on the part of the planters in a given locality are absolutely necessary, as the efforts of a single person combating or entirely eradicating an insect pest in a single field are of no avail when possibly his next neighbor's field is an ideal breeding place sufficient to supply the entire community.

In order to ascertain when and by what means active measures should be taken in regard to any pest, it is first necessary to study the habits and life history of the insects in question and it is here that the planters can aid greatly by reporting injurious insects and submitting to this Bureau specimens of the plants attacked, together with live and alcoholic insect material.

Numerous requests are made on this Bureau for remedies for various insects, but in most cases they simply state that "an insect is injuring the crops" and ask for the best method of treatment. To requests of this kind it is imposible to give any definite answer without knowing the kind of insect or its method of attack.

Sometimes we receive notice that insects are destroying coconuts, palay, shade trees, or other plants, and we are requested to make an investigation. It is not infrequent that we find, upon investigation, merely the results of the insects, or that the latter are in the last stage of development and that the damage by the prevailing generation is already done. In such cases treatment is of no avail. The danger is over and the plants are safe until the appearance of the succeeding generation. If these insects had been reported in due time, their ravages could have been checked, or a study of the life history and habits could have been made and a remedy given for future outbreaks.

In order for us to give remedies and answer questions intel-

ligently, persons requesting information relative to destructive insects should observe the following points:

1. Insect ravages should be reported at first appearances and not when damage is done.
2. Always submit specimens of the insects in question and of the infested plants.
3. Give the general character of the injury and extent of damage.
4. State the part of the plant attacked.
5. In submitting specimens put them in alcohol or "vino" and give all possible information concerning the insect and its habits.

NATURAL INSECT CONTROL.

Many factors, such as birds, climatic conditions, predatory and parasitic insects, may be placed under the heading of natural insect control. Of these, parasites may be put at the head of the list, as they attack various insects in the egg, larval, pupal, and adult stages. Hymenopterous parasites are probably in excess of all other orders of insects.

A noteworthy incident of natural insect control occurred recently when the eggs of a Pierid were parasitized by a small Hymenopter to such an extent that the ravages of the last generation of this insect were rendered negligible.

The eggs of this Pieridæ are deposited singly on the under side of the leaves of *Cassia siamea* Lam. Upon hatching, the larvæ have heretofore, during the course of their development, completely defoliated the trees which they had attacked.

During November of last year eggs were noticed to have been deposited liberally on the leaves of these trees; some were taken to be bred in the laboratory, and preparations were made to spray the trees when the eggs should have hatched. The collected eggs hatched, but those on the trees did not. Upon examination the latter were all found to be parasitized.

OCCURRENCE OF THE COCONUT WEEVIL.

A recent report from one of the localities known to be infested by the red weevil (*Rhynchophorus ferrugineus* Fabr.) states that the injury by this insect has become so noticeable that remedial measures have been applied. In the municipality of Ambalang, Oriental Negros, the planters are extracting these weevils from the coconut and burí palms. It is reported that one man has killed as high as 800 of these insects in a single day. During the period from the middle of January to February 4, over 52

thousand of these insects were destroyed by the various coconut growers in the above-named section, the greater number of these being taken from burí palms.

At present there are four localities, Oriental Negros, Zamboanga, Laguna, and Tayabas, where this insect causes considerable damage, but to date only the above report has been received as to their appearance this season.

PLANTS RESISTANT TO INSECT ATTACK.

Plants often resist insect attack by "abnormal" growth and by exuding a sticky sap or other similar substance. A noteworthy instance of a plant resisting the attack of insects occurs in the seed heads of lettuce (*Lactuca sativa* L.). Upon the slightest touch to lettuce seed heads this plant exudes a milky, sticky substance, and when the insects alight upon it they are immediately fastened to the plant, and in their efforts to get away the plant is disturbed still more causing it to throw out still greater quantities of this protective latex, till at last the insects are held rigid and thus soon die. Lately, at Singalong, it was noted that the lettuce seed buds were covered with dead insects, including the following:

Pentatomidæ: *Nazara viridula* Fabr.; *Eurydema pulchrum* Westw.

Pyrrhocoridæ: *Dysdercus singulatus* L.; *Dysdercus poedilus* H. S.

Capsidæ: One species; Hymenopterous parasites, four species; Diptera and Microdiptera, five species.

Chrysomelidæ: *Aulacophora coffeæ* Hornst; one other species.

Lygaeidæ: One species.

Reduviidæ: One species.

NOTES BY P. J. WESTER, Horticulturist.

CINCHONA.

Ever since the efficacy of quinine against malarial fevers was discovered and the drug introduced into Europe in 1639, there has been great interest in the plants from which this valuable drug is obtained, especially among those European nations possessing colonies in the Tropics, and subsequent to the introduction of the cinchona plant into India in 1861 its cultivation has spread over considerable areas in that country; it is also extensively cultivated in Java.

The cinchona is indigenous to tropical South America, occurring between the tenth and the twentieth degree of latitude and is found at its best at an altitude of from 450 to 1,800 meters. The number of species that yield quinine is considerable, but there are only a few that are sufficiently rich in the drug to warrant their exploitation for this purpose. *Cinchona calisaya* Weddell, of which there are several varieties, is richest of all in quinine (containing 5 to 6 per cent) and therefore this species is the one most extensively cultivated. One of its best-known forms is *C. ledgericena.* *C. calisaya* is a tree very variable in size that thrives best at an elevation of 450 to 900 meters. *C. succirubra* Pavon attains a height of 15 meters or more, and succeeds up to an altitude of 1,800 meters, preferring a cool climate. *C. officinalis* Hooker is a straggling tree some 6 meters in height; like the preceeding species it does best in the higher elevations. The cinchonas succeed best on hillslopes where the soil is rich and well drained and where the rainfall is fairly abundant, though in this latter respect they are not so exacting as was formerly thought. The plants are easily propagated from seeds or cuttings.

It is quite probable that the cinchonas will thrive in many parts of the Philippines having the right qualifications and the Bureau of Agriculture has recently introduced *C. calisaya* with this object in view.

A NEW OIL INDUSTRY.

The rest of the world has much to learn from Europe in the utilization of waste products. One of the latest bits of news in this line is the manufacture of grape-seed oil for culinary and industrial purposes in France, Italy, and Württemberg. We quote the following from the Daily Consular and Trade Reports for January, 1913:

> That obtained cold, from the first pressing, is edible; the oil obtained by pressing and heating, and that extracted by means of solvents, have a dark color and a bitter taste, and after being purified by concentrated sulfuric acid and cleared with bone black, are used for lighting purposes and in the manufacture of soap and, on account of the small cost, they would be a good substitute for the expensive oils used in the textile industry. Aside from the uses mentioned, and because some of its chemical properties are similar to those of castor oil, grape-seed oil has suggested itself as a substitute for castor oil in the preparations of compounds used in the manufacture of red colors.

The quantity of oil that can be obtained from the seeds varies from 6 to 20 per cent according to the variety of grape and

the degree of ripeness. On an average, 1 kilo of oil is rendered for each hectoliter of wine produced.

THE OLIVE-OIL CROP IN THE MEDITERRANEAN COUNTRIES.

We may look for an advance in the price of olive oil. Owing to the spread of the olive fly and its recent severe ravages in all olive-producing countries bordering the Mediterranean, the current year's crop will be greatly reduced. The yield in Italy is estimated to be only two-thirds, and in Spain only one-fourth of a normal crop. In France the outlook is for a fair crop, but inferior in quality; in Corsica the olive is this year a total failure and in Algeria the crop is insufficient for local consumption. In Tunis, Asiatic Turkey, and Greece the crop will be poor and mediocre in quality.

The olive fly is a relative of the Mediterranean fruit fly which has been so destructive to the orchard fruits in that region, from which it takes its name; it has also been destructive in South Africa and Australia; more recently, it has become notorious through its invasion of Hawaii. It is also related to the mango fruit fly discussed by the writer in a previous issue of the REVIEW.

MATÉ OR PARAGUAY TEA.

In South America the maté occupies the position filled by tea in England and in the United States and the preparation of maté is in certain parts of the continent an industry of paramount importance. However, the leaves have so far been gathered chiefly from the forest and there are no regular tea plantations such as one finds in Japan, Java, and other parts of the East. Owing to the enormous extent of the maté forests no thought has been given in the past to their possible exhaustion and the harvest of the leaves has proceeded with little or no regard for the maintenance of this source of wealth. Paraguay now seems to have awakened to the danger of loosing her revenues from the maté industry and a law has been promulgated regulating the exploitation of the maté forests, limiting the gathering of a crop of leaves in any one place to once in every four years.

There is already a limited demand for maté in Latin Europe and small experimental shipments of the product have been made to the United States, though as yet this beverage is practically unknown to the Anglo-Saxon. There is but little doubt, however, as to its future ranking in popularity with ordinary tea and coffee.

Maté was introduced into the Philippines some years ago and a plant in flourishing condition may be seen at the Singalong experiment station. The species is of very vigorous growth, and, should it ever become expedient to grow it in the Islands, the present indications are that it would succeed exceedingly well.

FOX FARMING.

In most countries the fox is considered a predatory pest and its extermination is encouraged by bounties. Now comes news from Prince Edward Island of its domestication there. The domestication of the fox is not so very recent, for it dates back to 1888, or nearly a quarter of a century ago. It is the gradual extermination of the black and silver fox, with the attendant increase in the price of their pelts, that is responsible for the birth of this new industry. As much as upward of ₱7,800 has been paid for a single black-fox skin.

According to the Daily Consular and Trade Reports there are now some 50 ranches of considerable size on the island, and including those who keep from one to five pairs of foxes, the aggregate number of places where foxes are kept is estimated at 300 with nearly 2,000 animals. The total value of the fox ranches is computed at 8 million pesos. Profitable as is the pursuit in the production of skins, the revenue from the sale of breeding animals is still greater—₱20,000 to ₱30,000 have been paid for a single pair.

Fox farming has evidently passed the experimental stage in this part of Canada, if we may judge from the fact that legislation has been enacted for its protection in at least three provinces of the Dominion.

NOTES BY M. M. SALEEBY, Chief, Fiber Division.

CARLUDOVICA PALMATA IN THE PHILIPPINES.

Carludovica palmata is the plant which produces the material from which the famous panama hats are made. It belongs to the *Cyclanthaceæ* family and not to the *Palmæ*. The plant resembles the young burí (*Corypha elata*) and the young anahao (*Livingstonia*) palms before their stems have appeared. The specific part of the name of this plant refers to its general resemblance to a palm tree.

C. palmata is a stemless plant having leaves plaited like a fan and borne on a three-cornered stalk which ranges from 2 to 4½ meters in length. The leaves proper are about 1⅓ meters in

diameter, deeply divided into four or five divisions, each of which is again cut. The plant flourishes in shady places all over Panama and also along the coasts of Ecuador and Colombia in South America.

The method used in Panama in preparing the leaves of *C. palmata* for weaving hats is very similar to that used here in the Philippines in preparing sabutan leaves for weaving sabutan hats.[1] This method is briefly as follows: The leaves are cut before they are expanded, and the woody ribs, or stiff parallel veins, are removed. The leaf is then slit into narrow strips which remain attached at the stalk end. These strips are then immersed in boiling water for a short time and afterwards dried and bleached in the sun. When completely dry the strips roll up into a straw-like form, at which stage they are bleached prior to hat weaving.

A few years ago some *C. palmata* seed was received by this Bureau and planted at the Lamao experiment station. This seed did not germinate satisfactorily, due probably to deterioration, and only two plants were obtained from it. These plants, however, made a very fair and rapid progress. Late last year as many as 40 shoots were obtained from these two plants, which were planted in a separate plat from which they will later be transplanted to the La Carlota experiment station, Occidental Negros, where the rest of the fiber experiments are being caried on. A request has also been made by the fiber division to secure a fresh lot of seed from Panama, and as soon as this is received it will be planted in a nursery at La Carlota for future distribution of seedlings and shoots. The seed is considered too delicate to be handled by persons who have no expert knowledge in germinating very small and delicate seed similar to the kind in question.

C. palmata is now cultivated in Java and hats are being woven from the prepared leaves by Javanese women and children, and the Java panama hat compares favorably with the common grades turned out in Panama. Conditions in the Philippines appear to be also favorable to the growth of the plant, and with the unexcelled skill of the Filipinos in the art of hat making, it is believed that the panama-hat industry can be successfully established in those provinces in which hat weaving is the chief household industry.

---

[1] See Current Notes in the April, 1913, issue of this REVIEW.

ANABO (*Abroma augusta*).[1]

This plant is found growing wild throughout the Archipelago.[2] It is cultivated as an annual crop only in the town of Bacolor, Pampanga Province, where it is grown from seed planted during the latter part of September. The soils best adapted for the growth of this plant are the low, wet soils, such as are required for rice. The plant attains a height of 2 to 5 or more meters when full grown. It usually takes seven or eight months from planting before the stalks are mature. This period, however, may be considerably shortened by proper cultivation.

The fiber is a bast derived from the bark of the twigs. The bark, after being stripped off, is soaked in water for four or five days, when the fiber can be readily separated. The fiber, when properly cleaned, is soft, white, and strong. Up to the present time it has been used merely for local purposes. Ropes, hammocks, and nets for hunting deer are the principal articles manufactured from it. It is believed that the fiber can be used for many purposes for which jute and other similar fibers are employed. Several samples of this fiber were forwarded to cordage manufacturers, both in the United States and England, for their opinion regarding its prospects as a commercial fiber. The following is an extract from the report of Messrs. Smith and Schippers, of New York:

> We believe this fiber will be of value commercially, but to get a decent market price the fiber would have to be better cleaned. There seems to be quite a little gum left in the sample, and this causes the fiber to be matted, which makes it difficult to spin. A little more attention paid to the cleaning would result in a pretty good fiber, in our opinion.
>
> The length and strength are satisfactory for a fiber of this kind, and the color is good. We should say it resembled more than any other fiber Tientsin, China, jute, and could be used for the same purposes, i. e., as a mixer with Indian jute, and for some grades of tarred cordage. As a mixer, the color must be all right, but the chief point in its favor is its length, as it helps to carry the shorter fibers which are used along with Tientsin in the making of cordage.

The fiber division of this Bureau, basing its efforts upon the above-mentioned report and others from other sources, has already taken up the question of the cultivation of anabo and the preparation of its fiber, with the view of determining whether

---

[1] Sometimes known as "devil's cotton."

[2] Other species belonging to other genera are found, which are also called "Anabo."

or not this can be carried on on a commercial basis. It is believed that the cultivation of anabo as an alternate crop with rice will give good results, providing a practicable method can be devised by which the fiber can be properly cleaned and providing a sufficiently high price can be obtained for it.

ANNOUNCEMENT.

GHENT INTERNATIONAL EXHIBITION, 1913.

TENTH INTERNATIONAL CONGRESS OF AGRICULTURE.

The International Congress of Agriculture which will be held at Ghent, Belgium, June 8–13, 1913, is the tenth of the series of periodical congresses which were inaugurated at Paris in 1889.

Agricultural meetings had hitherto been organized in various countries at indefinite dates. They had no connection with each other, and their influence was merely temporary. At the congress which was held in Paris, on the occasion of the international exhibition of 1889, a permanent committee was constituted, and under the designation of the International Commission of Agriculture, was charged with the duty of convening and organizing congresses at subsequent dates. This commission includes among its members leading representatives of the principal agricultural associations, etc., in various countries; and with M. Jules Meline as its chairman, it has unceasingly and actively continued to fulfil its mission.

The extensive series of reports which have been issued by these congresses indicate the importance of the work which they have accomplished, and their effect in diffusing knowledge of the agricultural progress which has been attained in various countries. The meetings, moreover, are of great advantage as a means whereby specialists and agriculturists of all countries get to know and esteem each other, fostering good fellowship which tends to mutual advantage.

Each congress decides where the next one shall be held. The ninth congress at Madrid accordingly accepted the invitation of the Belgian members of the International Commission of Agriculture that the tenth congress should meet at Ghent on the occasion of the international exhibition of 1913.

This congress will be international in the widest sense of the term, inasmuch as the subjects on the program may be discussed from a universal point of view, notably as regards tropical agriculture.

The committee which has accordingly been formed in Belgium has prepared the program of the congress in consultation with the international commission. It therefore appeals to the agriculturists of all countries, including colonies, to assist in making this meeting worthy of its predecessors.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

FEBRUARY, 1913.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		S. Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	25.2	3.8	25	------	26.1	------	25.1	------	21.6	------	23.8	------
2	25.7	------	24.3	13.6	26.3	------	26	------	22	------	24	------
3	26.3	------	24.6	26.1	25.8	------	26.2	------	22.4	------	23.5	------
4	26.4	19.9	24.4	16.6	25.7	------	26	------	23.3	------	24	------
5	24.6	40.5	25.8	------	26	------	25.5	------	23.7	------	24.2	------
6	24.2	24.2	25.3	12.4	26.8	------	26.4	------	23.6	0.8	24.4	------
7	25.9	------	26.3	------	26.9	------	27	------	22.2	3.4	25.2	------
8	25.9	2.3	26	------	26.3	------	26.6	------	23.3	------	25.8	------
9	26.3	------	26	------	26.4	------	26.7	------	23.8	26	26.8	0.3
10	25.6	3	25.7	------	26.5	------	26.9	------	24	6.9	26.8	------
11	25.6	30.9	25.6	1.5	26.5	------	28.6	------	21.1	18.9	25.9	------
12	23.7	25.3	24.1	23.1	25.4	------	26.9	------	21	.8	24.9	------
13	24.6	1	23	104.9	25.2	------	26	------	22.4	------	25	------
14	26.1	------	25.7	1.3	25.9	------	25	------	23.8	------	25.6	------
15	25.9	------	25.6	------	26.1	------	26.8	------	24.7	------	25.2	------
16	26.2	------	25.8	------	25.6	------	28.4	------	24.2	1	25.4	------
17	26.2	------	26.4	------	25.8	0.8	26.6	------	23	.3	24.7	------
18	27	.5	26	------	25.6	------	24.9	------	24	------	24.6	------
19	26.9	------	25.7	7.4	25.9	------	25.6	------	24.7	------	25.4	------
20	25.6	20.1	25.8	2.6	26.4	------	25.8	------	24.4	------	23.6	------
21	26.1	------	24.9	37 8	27	------	25.2	------	24.7	------	25.6	.3
22	27.1	.8	26.7	------	26.9	------	28	------	26.1	------	27.2	------
23	26.7	------	26.7	2	26.2	------	27.2	------	25.2	------	26.7	------
24	25.8	10.3	25.4	7.9	26	------	27.1	------	24.9	------	27.1	------
25	26.4	------	26.4	------	26.8	------	27.6	------	25	------	26.2	------
26	26.8	------	26.2	1.3	26.2	------	28.7	------	24.9	------	26.4	------
27	27	------	24.9	15.7	25.8	------	28.6	------	24.4	4.1	25.5	------
28	27	------	25.1	43	26.7	14.5	28.7	------	23	2.4	26.2	------

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Vacant.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Assistant Horticulturist, H. H. BOYLE.

Entomologist, C. R. JONES.
Assistant Entomologist, D. B. MACKIE.

AGRICULTURAL INSPECTORS.

H. R. REED. W. A. MACE. F. P. NICKLES. F. C. KINGMAN. H. O. JACOBSON. I. C. ROOT.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	P. J. WESTER, Horticulturist in charge.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	E. F. SOUTHWICK, Acting Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, In Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	Vacant.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

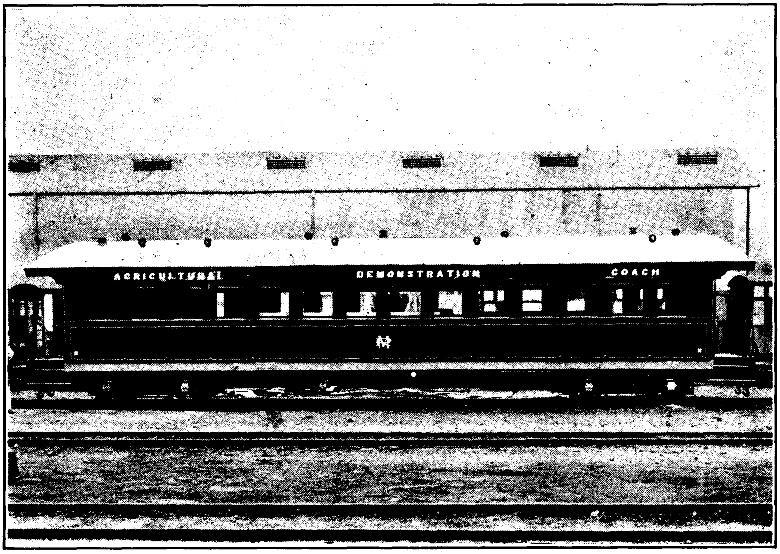
SUPERVISING VETERINARIANS.

Charles G. Thomson. Stanton Youngberg. Charles H. Leavitt.

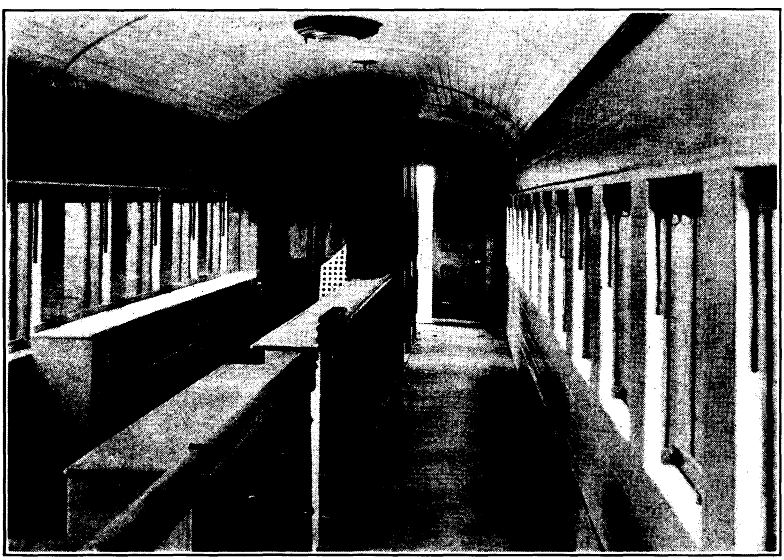
VETERINARIANS.

J. B. Bell.
W. R. L. Best.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. A. Curtis.[1]
W. L. Davis.
Charles H. Decker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.[1]
A. H. Julien.
Harry F. Kern.
William A. Kliphardt.[1]
Walter A. Korb.
A. M. Meade.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.[1]

[1] On leave.



(*a*) Agricultural demonstration car now under construction.



(*b*) Interior of demonstration car.

DEMONSTRATION AND EXTENSION NUMBER

THE PHILIPPINE

Agricultural Review

VOL. VI JUNE, 1913 No. 6

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

COÖPERATIVE AGRICULTURAL DEMONSTRATIONS.

By the ASSISTANT TO THE DIRECTOR.

There is urgent demand in this day and generation for plain, practical, and positive results. It matters not if it be a man, a machine, or a method, the degree of efficiency is measured by the results obtained.

In no field of effort is this more true than in that of agriculture. Farming is a very practical business proposition, and the business that does not show results does not last very long. Farms are not operated, in the vast majority of cases, as an amusement, but to furnish a living for the farmers.

What is true of farming in general applies, at least in some degree, to any measures taken for the improvement of agriculture. The two cases are not entirely parallel for the reason that the Government with its bureaus, experiment stations, colleges, and schools very properly carries on lines of investigation which must often bring negative rather than positive results. That which is demanded of the Government in its agricultural work, and it is an entirely reasonable demand, is that the results obtained by investigation be so transmitted to the farmers that they may be used in a practical way.

The most vital industrial problem now before the people and the Government of these Islands is to devise and put into active operation a practical and comprehensive scheme that will insure the healthy development of our agriculture. Although endowed with enormous natural wealth, chiefly agricultural, the country has suffered from a long period of industrial depression. The work of improvement has been well started and it is imperative that it be continued and developed in an effective way.

The work of promoting agricultural improvement by means of "coöperative agricultural demonstrations" is not a new idea, neither is it an experiment. This system was first utilized by the United States Department of Agriculture in 1904 with one inspector working on one farm. Eight years later 600 inspectors were carrying on coöperative demonstrations with a hundred

thousand farmers. This development was due to the simple fact that this work gives results.

In the Philippine Islands coöperative demonstration work has only recently been established. It is of interest to note, however, that in one province more corn was hauled by the railway in the three months following the first period of demonstration work than had been hauled during the previous three years. In another province more agricultural implements were sold in six months than had been sold during the previous four years. These are surely practical and positive results.

In this number of the REVIEW an outline is given of the principal features of the coöperative demonstration work, its present status in the Philippine Islands, and the plans that have been made for its development.

COÖPERATIVE AGRICULTURAL DEMONSTRATIONS.

By H. T. EDWARDS, *Assistant to the Director.*

There are in the Philippine Islands approximately 815,000 farms. Of this number about 725,000, or nearly 90 per cent, have an area of less than 5 hectares each. The men who work these small farms constitute the great bulk of the farming population of the Islands, and any scheme for the general improvement of agricultural conditions throughout the Archipelago must be based on measures adapted to reach and influence the small farmer. It is frequently stated that the Filipino farmer has no desire to adopt improved methods, and that he will not change his present practices. Experience has shown, however, that there is a widespread demand on the part of the farmers throughout this country for information, and wherever it has been possible to clearly demonstrate that the use of modern methods will produce satisfactory results these methods are eagerly and quickly adopted.

A mistake that has been altogether too common has been the attempt to introduce practices for which the Filipino farmer is not yet prepared. The average small farmer in the Philippines has practically no working capital. He usually has but one or two work animals and frequently none at all. His farm equipment is of the most meager description, and he has not the means to make any immediate extensive improvements in this equipment. He is accustomed to growing one or two crops, and to the use of methods that have been followed in his community for generations. All of these conditions should receive full consideration before any work is undertaken to improve agricultural conditions in the Philippines. There are, of course, many exceptions to the above-stated conditions. Large and well-developed plantations on which modern improvements can be immediately introduced are to be found in every province. The essential fact remains, however, that 90 per cent of the farming population of the Philippines are the small farmers, and our most vital agricultural problem is to devise and put into active operation a practicable scheme that will enable these small farmers to improve the conditions on their farms. It is worth while to note in this connection that although improved practices suitable for the well-equipped plantation are often entirely beyond the reach of the small farmer, the improvements that can be

adopted on the small farm are equally valuable on the large plantation.

It is a well-established practice in the working out of any scheme which has for its object the improvement of agriculture to first ascertain certain facts by means of investigation and then to transmit this information to the farmers by means of correspondence, printed matter, and lectures. This method is not without its advantages and will produce, even in the Philippine Islands, a certain amount of results. In the vast majority of cases, however, it is entirely fruitless when it comes to the matter of improving the condition of the small farmer. The vast majority of Filipino farmers do not read either English or Spanish. Publications in the local dialects will be more widely read and lectures are even more effective than any printed matter, but in the end the fact remains that the Filipino farmer needs to be shown rather than told how to use improved methods.

It is a very simple matter to describe in great detail the advantages of using better implements and improved methods of soil preparation, the value of seed selection and seed testing, and the importance of thorough cultivation and diversification of crops. If results are desired, however, it is a thousand times better to go out on a farm in the provinces with a small, inexpensive modern plow; to show the farmers of a community how such a plow can be used, what it will do, what it costs, and where it can be purchased; to show how good seed can be selected and tested; to have this seed properly planted in ground that has been well prepared; and to see that the crop is cultivated, protected from insect pests, and properly harvested. In the one case a certain amount of casual interest may be aroused on the part of a limited number of people; in the other the entire community is given a definite, striking object lesson that can not fail of being understood. The second method of procedure is that which is known as coöperative agricultural demonstrations.

The Filipino farmer during the past decade has suffered from a series of disasters that in a country less richly endowed by nature would have been overwhelming. His herds have been decimated by rinderpest; his crops have been destroyed by locusts and drought; and certain sections have been devastated by typhoons and floods. Even under these unfavorable conditions there has been progress, and the general agricultural situation throughout the Archipelago is more encouraging at the present time than it has been at any previous time during the past ten years.

As a basis for future development, most important work has already been done. Rinderpest, which in earlier years made the question of agricultural progress in any province a matter of uncertainty, is now largely under control. Locust infestations of the most serious nature have been entirely eradicated in certain provinces and have been controlled in other sections during the past year, showing that the destruction of this pest is only a matter of energetic and coöperative effort. Irrigation works are being developed in different parts of the country which will eliminate in the sections where these works are constructed the danger of loss from drought. Transportation facilities have been enormously improved by the construction of better roads in all provinces and by the building of railroads through the more densely populated sections of Luzon, Panay, and Cebu. Investigational work along agricultural lines has resulted in the acquirement of valuable information that can now be utilized to advantage on Philippine farms. In addition, and what is perhaps more important than any of the factors previously mentioned, is the fact that the Philippine farmer is beginning to realize the advantages of using improved methods of agricultural practice, and is seeking the means of bringing these methods home to his own farm. This is shown by the rapidly increasing demand that is being made by the farmers for information and assistance from the Bureau of Agriculture.

The most important feature of our agricultural problem at the present time is to develop simple and practicable methods that will influence the farmers of these Islands to adopt improved practices. The farmers are ready for such improvement, and the information which they desire is, in a large measure, available. This work is already under way and has been carried on to a limited extent in several provinces during the past year. During the coming fiscal year it will be largely increased under the provisions made by the Philippine Legislature for the establishment of a system of coöperative agricultural demonstrations.

This system of coöperative agricultural demonstrations has been widely discussed and is now quite generally understood. Briefly stated it is a method by which information is taken to the farmers and directly taught to them on their own farms. Instead of attempting to disseminate information solely by means of correspondence or publications, trained and experienced men are sent out to the farmers of the different districts. In each locality the progressive farmers who desire to take up the work are enlisted as coöperators. On the farm of each coöperator a

plot of land is selected and this plot is prepared, planted, cultivated, and harvested by the farmer working under the direction and with the assistance of the inspector. The entire crop goes to the farmer who receives not only the benefit of the instruction, but also increased returns from his land.

The coöperative demonstration work is not an experiment, and under normal conditions success is practically assured. The Bureau of Agriculture corn demonstration plots in the Province of Cebu during the past year yielded an average of 59.1 cavans [1] per hectare. The average yield on land farmed by methods in common practice in the Province of Cebu was 32.5 cavans per hectare. The yields on demonstration plots cultivated by modern methods were, in this instance, 81 per cent higher than the yields on lands of the same character cultivated by the old methods. Equally positive and convincing results have been obtained in other localities where demonstration work has been carried on.

It was believed, when this work was first started, that difficulty might be experienced in obtaining the necessary coöperators. As a matter of fact, the very opposite has been the situation, and it has been impossible to furnish a sufficient number of inspectors to supervise the plots of farmers who have expressed a desire to become coöperators. This is particularly true in localities where the work has been under way a sufficient length of time to demonstrate its value.

Up to the present time coöperative demonstration work has been started by the Bureau of Agriculture in the following-named provinces: Cebu, Iloilo, Capiz, Surigao, Bohol, Albay, Batangas, Laguna, Rizal, Isabela, Nueva Vizcaya, and the Mountain Province. In several of these provinces the work has only recently been organized, in others it is now well-established and already beginning to show definite results.

Agricultural demonstration work, although comparatively new in the Philippine Islands, has been thoroughly worked out in other countries. Wherever it has been adopted it has been a success, and this method of instruction is now generally recognized as the most practical and effective system known for promoting agricultural improvement. Conditions in the Philippines are such that the establishment of coöperative agricultural demonstrations throughout the Islands appears to be entirely feasible and in every way desirable. There is abundant indication that such a movement will receive the hearty support of Philippine farmers.

---

[1] One cavan equals 75 liters.

A. B. No. 396.

THIRD PHILIPPINE LEGISLATURE,

Special Session of 1913.

[No. 2226.]

An Act to establish stations for practical instruction in matters concerning agriculture and a system of agricultural demonstration and development.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. The Director of Agriculture is hereby authorized to establish, equip, maintain, and operate in such places in the Philippine Islands as may be considered suitable for the purpose, stations for practical agricultural instruction, and to establish, organize, maintain, extend, and develop, and from time to time change and improve, a system of coöperative agricultural instruction, all for the purpose of teaching perfected methods of soil selection, preparation, and fertilization, planting and harvesting vegetables, fruits, cereals, and other crops, production of improved seeds and plants for distribution, improvement of the breed of animals used for agriculture, and to further by other means and encourage and teach agriculture and agricultural work.

SEC. 2. Whenever circumstances are deemed favorable, stations for practical agricultural instruction may be established and conducted, maintained, equipped, and operated coöperatively by the Bureau of Agriculture and any province, municipality or agricultural association of the Philippine Islands; but any station for practical instruction established under the provisions of this Act shall be managed under the supervision and control of the Director of Agriculture.

SEC. 3. The Director of Agriculture is hereby authorized to appoint and employ station superintendents, traveling inspectors, clerks, operators, messengers, and all other employees deemed necessary for carrying on successfully the work to which this Act refers, and to fix their salary; to purchase or lease the necessary land and buildings, to install wells and other irrigation

systems, to acquire by purchase, donation, exchange, or other contract, all animals, plants, fuel, machinery, vehicles, apparatus, equipment, tools, implements, and articles necessary for the proper operation of this Act, and to expend for these purposes the money appropriated by this Act.

SEC. 4. The duties by this Act imposed upon the Director of Agriculture shall be performed under the general direction and with the approval of the Secretary of Public Instruction.

SEC. 5. The sum of one hundred and fifty thousand pesos per annum or so much thereof as may be necessary, is hereby appropriated, out of any funds in the Insular Treasury not otherwise appropriated, to carry out the provisions of this Act.

SEC. 6. This Act shall take effect on July first, nineteen hundred and thirteen.

Enacted, February 7, 1913.

A. B. No. 284.

THIRD PHILIPPINE LEGISLATURE,

Special Session of 1913.

[No. 2229.]

An Act authorizing certain measures for improving the planting, curing, and preparation of tobacco.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. It is hereby directed that the Director of the Bureau of Agriculture station in the tobacco-producing provinces employees of his Bureau, experts in the planting and production of tobacco, to make experimental demonstrations in suitable municipalities or places, relative to the adoption and use of modern methods of planting, cultivating, curing, and preparing tobacco and the selection of the soil, the planting and cultivation of foreign tobaccos, and any measures that may be necessary for instructing the tobacco growers.

SEC. 2. The Director of the Bureau of Agriculture shall, for the purposes of this Act, establish in the province or provinces where he may deem it advisable, an experimental station dedicated especially and exclusively to experiments in tobacco cultivation and production.

SEC. 3. The sum of ten thousand pesos is hereby appropriated, out of any funds in the Insular Treasury not otherwise appropriated, for carrying out the provisions of this Act: *Provided,* That provinces and municipalities desiring to be benefited by such experimental demonstrations shall participate in the expenditures occasioned by such experimental demonstrations, which shall be assessed pro rata by the Governor-General; but in no case shall the share of the province or municipality exceed two-fifths of the actual cost of such experimental demonstrations: *Provided, however,* That the share of the municipality shall in no case be equal to or larger than that of the province: *And provided further,* That the sum appropriated by this Act shall not be applicable to salaries and expenses of the personnel appointed by the Director of Agriculture.

Enacted, February 8, 1913.

A DEMONSTRATION PROJECT.

By H. T. EDWARDS, *Assistant to the Director.*

Under the present organization of the Bureau of Agriculture the entire work of the Bureau is carried on under a series of so-called projects. Each project covers a certain definite line of work, is under the supervision of some one employee who is directly responsible for the results obtained, and for each project a fixed allotment of funds is made to cover the expenditures of each fiscal year.

Each project of the demonstration and extension division of the Bureau includes the work of a certain district, ordinarily one province or island. Thus we have at the present time the Cebu project, the Panay project, the Mountain Province project, etc. It is proposed ultimately to establish one demonstration project for each province in the Archipelago, with such number of coöperative demonstration stations as may be required by existing conditions.

There are two main lines of work in connection with each demonstration project, viz, the demonstration station and the coöperative plot work throughout the province. The principal object in having the demonstration stations or farms is to provide a centrally located headquarters for the work of that province, and a place where certain lines of work can be carried on to better advantage than would be possible on the farms of coöperators.

The demonstration station serves as a training station for the traveling inspectors. As new men are employed they are sent first to the station for preliminary instruction under an experienced man. Subsequently they return to the station from time to time and thus keep in touch with the work of other inspectors in that province.

A part of the land at each station is used for the growing of seeds and plants for distribution. Under favorable conditions, where seeds can be produced in large quantity, this line of work covers in considerable part the cost of operating the entire station.

Where live-stock breeding is carried on as a part of the demonstration work, as it will be in the majority of cases, the station is the headquarters for this work. At the Batangas station animal breeding has thus far been the most important and successful part of the work.

In certain provinces it will no doubt be found desirable to do a limited amount of experimental work either with new varieties of plants already grown, or with plants entirely new to that section. As the coöperative plots are not intended to be experimental, this work must necessarily be done at a station.

The demonstration station is, however, as its name implies, intended primarily as a place where field demonstrations can be carried out on a somewhat larger scale than on the farms of coöperators, and at a place where they will be observed by a larger number of people than would ordinarily see any of the coöperative plots.

The establishment and supervision of coöperative demonstration plots on the farms is the second part of the work of a demonstration project. This work is handled by traveling inspectors, to each of whom is assigned a certain definite district. It has been ascertained that an important factor in determining the success of the coöperative work is the frequency and regularity of the visits of the inspectors. It is by no means sufficient that the inspector select a suitable plot of ground and that he have this plot properly prepared and planted. From the time of planting until the crop is harvested each plot should be visited as frequently and as regularly as conditions will permit in order that suggestions may be given regarding cultural methods and the control of pests and diseases.

In the demonstration-plot work every effort is made to have the work as simple and practical as possible. The crops grown on the demonstration plots are usually those with which the farmer is familiar and which he has previously cultivated.

The main features of the coöperative demonstration work are as follows:

1. The selection of the crop best suited to the land available for the demonstration.

2. Drainage.

3. The thorough preparation of the land before the seed is planted.

4. The use of seed of the best variety obtainable, and seed that has been carefully selected and tested.

5. The use of proper methods of planting.

6. Intensive tillage during the growing season.

7. The importance of utilizing leguminous plants, barnyard manure, farm refuse, and any other available material suitable for building up and improving the soil.

8. Methods of controlling and eradicating plant pests and diseases.

9. The value of crop rotation.

10. The reasons for diversified farming.

11. The use of better tools and implements.

12. The proper care of live stock.

13. The production on the farm of all food required by both men and animals.

14. Farm management.

It is hardly necessary to state that each demonstration does not offer an opportunity for utilizing fully all of the above-mentioned lines of work. It is equally true that special cases frequently arise where work other than that usually covered by the demonstrations can be carried on to advantage.

In making the preliminary arrangements for a coöperative demonstration an effort is made to secure land that is near a public highway in order that the results of the demonstration may be observed by a large number of people. When the land for the plot has been selected, it becomes necessary to also select the crop best suited for this particular land. In this work the inspector can frequently furnish the farmer valuable suggestions with reference to the management of his entire farm, and the planting of crops best adapted to existing conditions.

Nearly all of the staple crops of the Philippine Islands require well-drained land. The question of drainage is one that has received but little attention on the part of the farmers. In many cases a simple, but at the same time effective, system of drainage that will greatly improve the condition of the soil can be installed with little labor or expense. It is preferable that land be drained by under drainage rather than by open ditches or the surface method. With tiles or bamboo laid below the tillage level the water will readily sink into the ground leaving the soil in good condition without carrying off any considerable amount of plant food. Water that would run off in an open ditch will be held in the subsoil where underground drainage is used and will be utilized by the growing plants in times of drought. The use of bamboo for under drainage will be given special attention in the demonstration work.

In the work of preparing the land for planting an effort is made to encourage the use of some one of the improved small

plows that are now on the market. In cases where such a plow is not available the ordinary native plow is used. Thorough preparation of the seedbed is of more importance than is generally realized, and this is required as the first step in the demonstration work. In order to obtain the best results with a crop it is essential that the soil be well pulverized and in good mechanical condition before the seed is planted. The methods of preparation vary more or less with different crops. Some plants require a deeper soil than others, and the seeds of certain plants can not be satisfactorily germinated except in a soil that has been very thoroughly pulverized, while other seeds contain a large amount of plant food which is used by the seedling until such time as the root system is fairly well developed. These various matters require consideration and attention in connection with the soil preparation.

The use of good seed is perhaps the most important line of work carried on in connection with the coöperative demonstrations. This work does not require any equipment on the part of the farmer and it can be used with all crops and in all localities. The fact that the use of poor seed is the rule rather than the exception in this country is one of the principal reasons why unsatisfactory results are obtained. It is not only necessary that good seed be used, but it is equally important that a variety of seed be planted which is adapted to local conditions. With the establishment of the demonstration stations it will be possible to produce in each province a supply of selected seed for local use, and by seed selection on the demonstration plots the supply will be still further augmented. Where it is necessary the seed used for the first planting of the demonstration plots is furnished by the Bureau of Agriculture, with the understanding that from that crop selected seed will be saved for the following planting. If the custom of using good seed can be generally established throughout the Islands this one improvement alone will result in a vast amount of benefit to the farmers.

Improved methods of planting is an improvement that requires no increase in labor or expenditure. It costs no more to plant a hectare of maize properly than it does to plant it according to methods now in general use. As a matter of fact the cost is generally less as too close planting and consequent waste of seed is the usual practice in this country. The reason for giving enough space between the plants in the row, and between the rows, lies in the fact that every plant requires sunlight and air, and room for development both above and below the surface of the ground. In the demonstration work the aim is to plant such

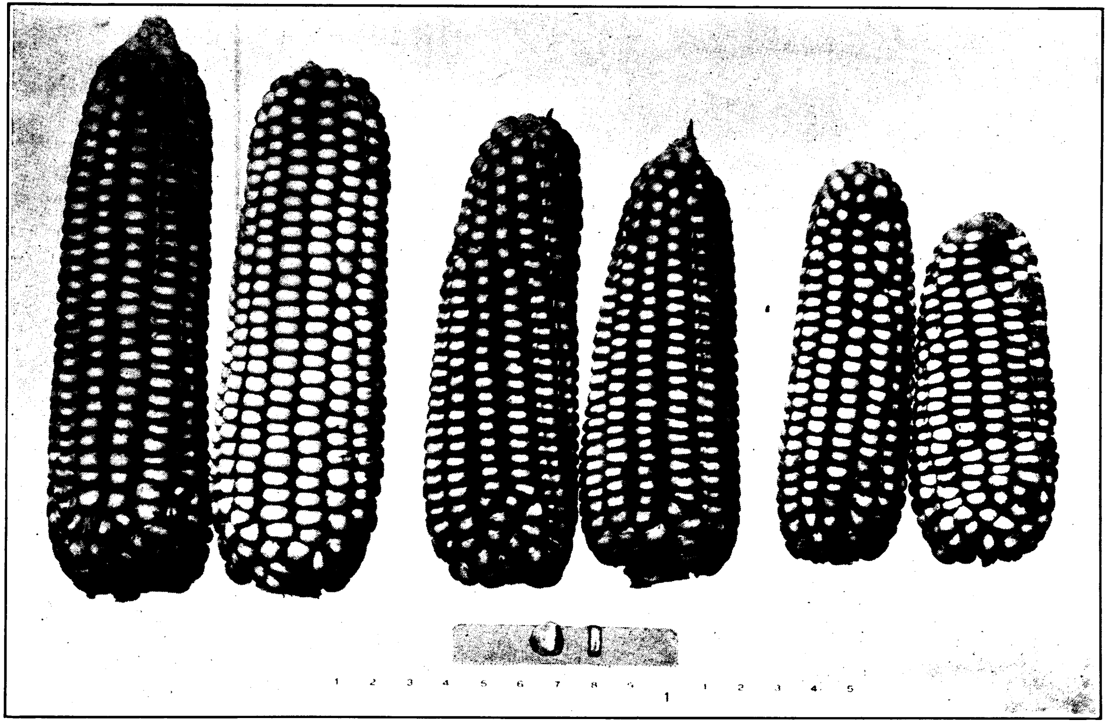
an amount of seed as will give the maximum amount of product on a given area. One has only to observe the great tracts of coconut land where the trees are planted so close together that the yield is reduced to a minimum, the abacá plantations where similar conditions often prevail, and the fields of small, stunted maize, to appreciate the need for improved planting methods in the Philippines.

Intensive cultivation is an improvement in Philippine agriculture that will have to be introduced gradually. The demonstration inspectors endeavor not only to explain, but also to show by the results obtained the value of frequent cultivation of the crop during the growing season. The main objects of tillage of the soil during the growing season are three: First, to increase the supply of plant food by rendering the soil constituents available; second, to destroy weeds; and third, to conserve the supply of moisture for the growing plant. Thorough tillage also serves to keep the soil in good mechanical condition. It is a noticeable feature of this work that after one crop has been grown on a demonstration plot, and the coöperator fully understands that improved results can be obtained by more thorough tillage, the securing of proper cultivation of subsequent plantings is not a difficult matter.

The extent to which fertilizers can be profitably used in the Philippine Islands has not been fully determined. On the larger plantations where capital is available and where large areas are planted to a cash crop the use of commercial fertilizers is highly desirable. The majority of the small farmers are not in a position to purchase commercial fertilizers and must depend on home products. The more general planting of leguminous crops for green manuring, and the use of barnyard manure and farm refuse are measures that can be generally recommended. There is, at the present time, an enormous waste of good fertilizing material in these Islands, a large part of which should be saved and used on the land.

Throughout the growing season many of our Philippine crops are subject to the attack of insect pests and plant diseases. The average Filipino farmer has little or no equipment with which to combat these pests and diseases and as a consequence suffers serious losses that might, in many cases at least, be averted. During the past year several of the demonstration inspectors have rendered excellent service in the locust campaign. The control and eradication of a locust infestation depends in a large measure on the promptness with which the first outbreaks

PLATE II.



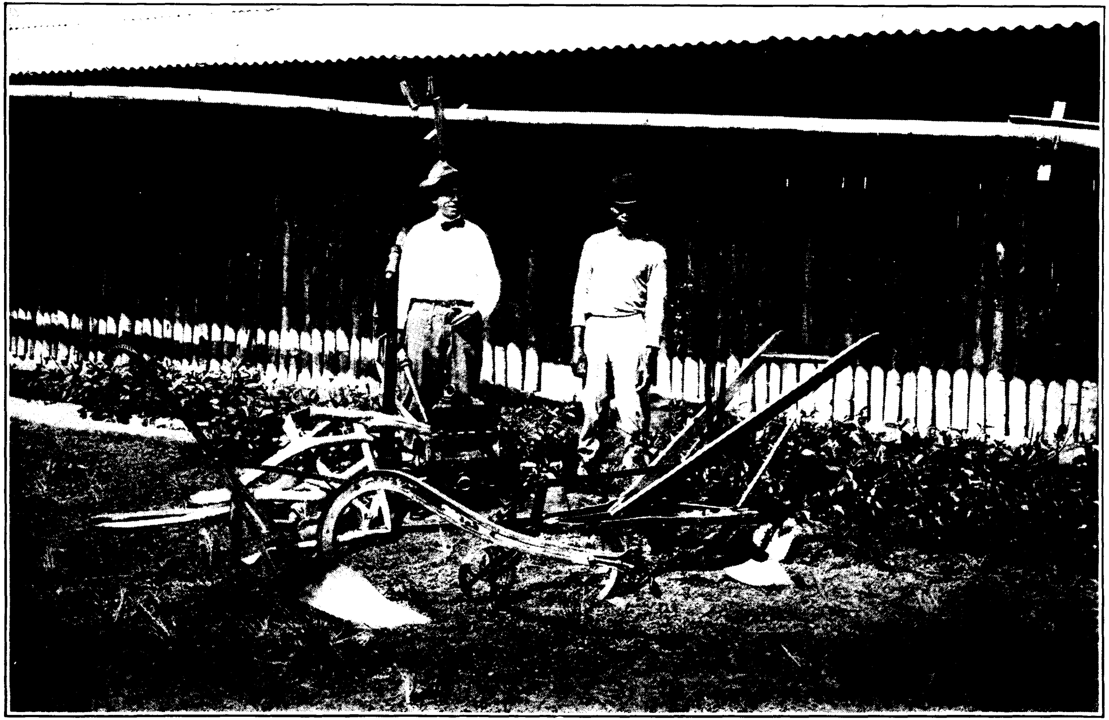
Native white flint corn, showing results of seed selection.

Tobacco field, showing "bagging" method of seed selection.

Iloilo demonstrators and demonstration products.

The Iloilo demonstration station.

Cutting cogon sod with a disk harrow at the Iloilo demonstration station.



Implements used in Iloilo demonstration work.

are handled and the efficiency of the work in its early stages. With a trained man on the spot, who understands local conditions and who has the confidence of the people, the work of controlling the locust pest is greatly facilitated. The conditions with respect to locusts apply equally well to other insect pests. The demonstration inspectors not only assist in the control of any particular outbreak, but also furnish information to the farmers which will enable them to continue this work in the future without outside assistance.

The "one-crop" system of farming is very generally followed throughout the Philippine Islands. In certain provinces rice is extensively cultivated and all other crops are neglected. In other provinces the one crop of importance may be abacá, sugar cane, or coconuts. When this one crop fails the results are bound to be disastrous. A severe drought in the rice provinces often results in a serious shortage in the food supply and occasionally is attended by considerable suffering and a condition of destitution. Under normal conditions in the abacá, coconut, and tobacco sections a very large part of the proceeds received from the sale of these crops is required for the purchase of food that should be grown on the farms. It is probable that the majority of the small farmers in the Philippines are not in a position to introduce any comprehensive system of rotation, or possibly to grow but one staple cash crop. There is no good reason, however, why these farmers should not grow secondary crops such as maize, garden vegetables, and friuts. During the last severe drought the rice districts in which maize was also cultivated suffered much less severely than those places where rice was the one crop. In the coöperative demonstration work special attention is given to the encouragement of gardening and the planting of fruit trees with a view of improving and increasing the food supply of the people.

It is impossible to obtain entirely satisfactory results when the land is prepared and tilled with the implements now in general use in these Islands. The fact must not be overlooked, however, that a very large number of Philippine farmers have not the necessary means with which to purchase improved implements. The aim of the demonstration work is to show the best possible work that can be done with the implements that are available, and also to show that better results can be obtained with better implements. Frequently all that is required is a demonstration of a good plow, harrow, or cultivator to insure the purchase of these implements by a number of farmers in each community.

It seems to be a very general condition that it is lack of information rather than lack of capital that prevents the more widespread use of modern farm equipment. Following the first season of demonstration work in the Province of Cebu more agricultural implements were sold in that province in six months than had been sold during the previous four years.

A very important feature of the demonstration work is in connection with the live-stock industry. There is urgent need that more attention be given to the building up of a prosperous live-stock industry in the Islands. This work includes the introduction of improved breeds of animals, better care of stock, and the control and eradication of diseases. The demonstration stations will be used as headquarters for breeding stock and from these stations breeding animals will be sent out through the provinces. The traveling inspectors furnish instruction to the farmers regarding the care and improvement of their live stock and report all outbreaks of animal disease.

The production of an improved and an increased food supply has already been touched upon under the subject of crop diversification. The importance of this matter can hardly be overestimated as it is the very foundation of the industrial prosperity of the Islands. It is a blot on our agricultural situation and hardly less than a disgrace to the Philippine farmer that the leading imports of the Islands are not only food products, but food products grown extensively within the Archipelago. This condition is a serious menace to the country and one that should by all means be remedied. The first work of the demonstration inspector is to impress upon the people the importance of producing on the farms sufficient food both for human beings and for domestic animals, and the demonstration plots will be largely used to show how this result can be accomplished.

In brief, the demonstration inspector acts in the capacity of a general adviser and assistant to the farmers of his district. The demonstration project is a measure designed to promote by simple and practical means the improvement of agricultural conditions in the province or islands which it covers. The above outline shows the general features of the work. Each project has its own problems and must be worked out in such a way as to fit in with local conditions. The projects thus far established have proven that this can be done, and the attitude of the farmers toward this work shows that it can be extended to other parts of the Islands.

DEMONSTRATION WORK IN THE PROVINCES AROUND MANILA.

By W. A. MACE, *Agricultural Inspector.*

It is estimated that the total area of land under cultivation at the present time in the Provinces of Bulacan, Rizal, Cavite, and Laguna is about 200,000 hectares. More than one-half of this area is planted to rice, which is by far the most important crop of this district. Other crops such as maize, abacá, sugar cane, and coconuts are grown very extensively in some localities in these provinces. Vegetable gardening is also an industry of considerable importance in a number of towns near Manila.

The general agricultural situation in this district around the city of Manila is somewhat different from that found in any other part of the Islands. One important factor in this situation is that the transportation facilities are such that produce can conveniently be taken to market at a very low cost. There are more than 250 kilometers of first-class roads and nearly 300 kilometers of second-class roads in this territory. The main lines of the Manila Railroad run through all of these provinces, while some of them have the benefit of additional branch lines. Many of the towns have excellent water transportation connecting them with Manila. In fact, no other section of the Islands is favored with such good transportation facilities as is the district around Manila.

A second factor, and one of great importance to the farmers, is the market. The city of Manila not only furnishes a market for all of the staple crops previously mentioned, but also for such secondary products as garden vegetables, fruits, poultry, eggs, etc. At the present time the supply of these secondary products is unsatisfactory with respect to quality and insufficient in quantity. The farmers of this district are missing, in a considerable degree, a golden opportunity; and the residents of Manila and other large towns in these provinces are unable to obtain the fresh vegetables and fruits, and good poultry and eggs of which there should be an abundant local supply. Any marked

improvement in quality will largely increase the demand for these products and will benefit not only the farmers but also the general public. An increase in the supply of fresh vegetables and fruits will tend to bring about a corresponding increase in the use of these healthful food products, a condition much to be desired.

A demonstration project has recently been established which includes the Provinces of Rizal, Laguna, Cavite, and Bulacan. This project is under the supervision of an agricultural inspector with three assistant inspectors detailed in the different provinces. The work of the demonstration project in the district around Manila will be carried on along the same general lines as all other demonstration projects. An effort will be made to develop and improve the production of the staple crops of the district, and to encourage the people to produce as far as possible their own food supply. In addition to this work, however, special attention will be given to market gardening and the poultry industry.

As a part of the work of this project a coöperative demonstration station has been established at Santa Cruz, Laguna. The provincial officials of Laguna first proposed the establishment of this station and have given the work the most cordial and effective support. A tract of land adjoining the provincial building at Santa Cruz, and having a flowing artesian well, has been set aside for the demonstration work and has been fenced by the province. This land is now being prepared and will first be planted to maize. At the next planting season a variety of crops will be planted.

Coöperators are now being secured in Rizal and Cavite, and the work will be extended into Laguna and Bulacan, with a view of having at least one demonstration plot in each town in these four provinces at the next planting season. The first work will be done with maize and garden vegetables, as these crops are generally grown throughout this district.

There is an excellent opportunity for carrying on effective demonstration work in the provinces around Manila. The farmers of his district are already beginning to take an interest in demonstration plots, and this interest should increase as the work begins to show results.

THE ILOILO-CAPIZ DEMONSTRATION PROJECT.

By SAM H. SHERARD, *Superintendent, Iloilo Demonstration Station.*

The Iloilo and Capiz demonstration and extension work was started in March, 1911. The work in this province up to the close of the calendar year 1911 was largely confined to the inspection of farms, seed distribution, and lecture work.

During the latter part of 1911 arrangements were made to carry on demonstration work in Iloilo and Capiz in coöperation with the Philippine Railway Company, and demonstration plots were secured. Work on these plots was confined almost entirely to one crop, maize. The planting of the demonstration plots was delayed on account of a severe drought which occurred during the latter part of 1911 and the first months of 1912. All of these plots were planted, however, in May and June. The method followed was to select the best seed available and to plant in "check rows" at distances of 1 meter, thus allowing for cultivation both ways. In addition to the plot work 23,500 ears of selected seed maize were purchased by the Bureau inspectors and paid for by the Philippine Railway Company. This seed maize was used on the demonstration plots, was distributed gratis to farmers planting under instructions, and was sold to others at the cost price of ₱2 per 100 ears. All of this seed was fumigated, thoroughly dried, and tested. The distribution of this selected seed has had a most important influence in increasing the production of good maize in Iloilo and Capiz. In connection with the demonstration plots and the seed distribution, the farm inspection work, lectures, and special work with tobacco were continued.

On July 1, 1912, the demonstration and extension work in Iloilo and Capiz was organized as a project. During the following month the Iloilo quarantine station of the Bureau of Agriculture was transferred to the demonstration division to be used as a demonstration station. This station is 2 kilometers from the city of Iloilo and is situated in a bend of the Jaro River. It contains 76,000 square meters of low and very fertile "gumbo"

soil. Owing to the nature of its use previous to being taken over for the demonstration work, it was in a very unsanitary condition and considerable time and money have been spent in preparing it for agricultural purposes. The entire station has been fenced and a large part of it has been platted and planted. Roads have been built, ditches dug, and the buildings cleaned out and repaired. In December 2 hectares were planted in maize, 800 square meters in cowpeas, and 500 square meters in pineapples. The remaining agricultural land on the station has been prepared and will be planted when the rains begin. The live stock at the station consists of 1 American stallion, 1 Nellore bull, 1 Berkshire boar, 1 billy goat, and 6 work bullocks.

The Iloilo station is now in splendid condition and will produce a sufficient quantity of good seed for distribution throughout the two provinces. It is a place to which farmers can come and see how crops should be planted and cared for, and where improved breeding animals are kept for service. This station promises to be an important factor in the demonstration work in Iloilo and Capiz.

From May to December, 1912, 14 maize demonstration plots were planted and harvested. At the present time 25 maize plots in Iloilo and 27 in Capiz are in excellent condition and will be ready for harvest in the near future. These plots vary in size from 500 square meters to 1.5 hectares and are scattered over a broad territory.

When it is considered that the average production of maize per hectare for the Philippine Islands is 8.22 cavans,[1] that maize planted the native way on river-bottom land in Panay gives a yield of only 26 cavans and 23 gantas per hectare, and that maize from selected and tested seed planted on this same river-bottom land and cultivated under the demonstration methods produced 95 cavans and 16 gantas per hectare, it is evident that this work is badly needed and that it produces results. The highest and lowest yields from the 14 plots harvested during September and October last were 98 cavans and 31 cavans, respectively, per hectare. On all of these plots the yield was from 25 to 150 per cent more than that produced on similar land in the same locality where the native methods were used.

The Filipino farmer, like the farmers of other countries, is inclined to be conservative when it comes to the question of introducing new methods. When the farmers' institutes were

[1] 1 cavan equals 75 liters.

held in Iloilo and Capiz last September, before the demonstration plots were harvested, several specimens of good and extra large ears of corn were used for illustrating seed selection. In every town and barrio where lectures were given the farmers would listen attentively, but after the lectures were finished they would smile and say, "Why, that is American maize; we can not raise big maize like that here." After the plots were harvested a second series of lectures was given on seed selection for the next crop. The large ears were again exhibited and they were all taken from the demonstration plots near the different towns where the talks were being made. In a number of cases the coöperators who grew this maize under the direction of the demonstration inspectors were called upon to explain that it was raised in the locality, and that it was "maiz del país" (native maize). There has since been no difficulty in obtaining coöperators.

The demonstration work has now been carried on in this district for about two years, and the farmers have about reached the point where they understand what the Bureau of Agriculture is trying to do for them. They are beginning to appreciate the work, and are learning to call on the demonstration inspectors for advice and assistance. The work is sufficiently advanced so that results can be seen, and the confidence of the farmers is being won.

It is stated by officials of the Philippine Railway that as a result of the demonstration work carried on by the Bureau of Agriculture in Panay more shelled maize was shipped into Iloilo from Capiz and way points during the months of August, September, and October, 1912, than had been shipped in the past three years. Inasmuch as the farmers can produce two crops of maize per year without irrigation, as this cereal is both a cash and a food crop, and as it can be grown on land that is not suitable for rice, it will be seen that the development of this industry is of great economic importance in Panay. Farmers are now growing maize in the Provinces of Iloilo and Capiz who never thought of planting it before the demonstration work was established.

COÖPERATIVE DEMONSTRATION WORK IN THE ISLAND OF CEBU.

By George G. Weathersbee, *Agricultural Inspector.*

During the month of April, 1911, an agricultural inspector was detailed to the Province of Cebu for the purpose of making a thorough investigation of this province with a view of establishing in Cebu a system of coöperative agricultural demonstration work.

The Island of Cebu is one of the most densely populated islands of the Archipelago. Agriculturally it is one of the poorest, having large areas of semiarid rocky land and comparatively small areas of good agricultural land. The principal crop grown in Cebu is maize, while tobacco, coconuts, sugar cane, rice, and a number of other minor crops are also cultivated in different parts of the Islands. The methods used in Cebu in the cultivation of maize are primitive in the extreme. In many sections the crop is planted on steep hillsides, the method of planting being to dig a small hole in the ground with a pointed stick, plant the seeds, and then take no further action until the time of gathering the meager harvest. Other crops than maize receive somewhat more attention, but throughout the island there exists the most urgent need for the introduction of improved methods.

The first work of the inspector after his arrival in Cebu was to visit every municipality in the province and to gather all possible data relative to the existing situation.

On this inspection trip two or more days were spent in each town visited. Upon arrival in a town the inspector first visited the municipal officials and requested the president of the town to call a meeting of the principal farmers of that section for the following day. In most of the towns a small amount of maize and garden seeds were distributed to farmers who agreed to follow the instructions given in planting and caring for these seeds and to report results to the Bureau of Agriculture. When

it was possible to do so, a number of farms were visited and suggestions given to the owners regarding practical methods of improvement. The meetings called by the president were usually well attended. Talks were given by the inspector on various agricultural subjects, an effort being made to select such subjects as would be of particular interest to the farmers of the town in which the lecture was given. At each meeting a list was made of the principal farmers of the town, including data regarding the area of each farm, the number of work animals, the kind of crops raised, and any particular line of agricultural work that the farmer in question might wish to take up. The matter of forming agricultural associations was discussed and encouraged.

After this inspection was finished four of the principal towns in Cebu were selected as suitable places for starting demonstrations and coöperators were secured in each one of these towns.

In November, 1911, an arrangement was made to carry on demonstration work in coöperation with the Philippine Railway Company and to establish demonstration plots on land occupied by the railway right of way. The staple crops of the province were to be grown on these plots and the work was to be done by farmers whose land bordered on or was close to the plots. Transportation for the inspectors and office and seed room were furnished by the railway company, while commercial firms in the town of Cebu contributed agricultural implements and fertilizers. During the months of November and December, 12 maize plots, 2 sugar-cane plots, and 5 rice plots were selected and prepared for planting.

In connection with the demonstration plot work the agricultural inspectors are engaged in such other activities as may serve to promote the agricultural interests of the districts where they are employed.

During the period above mentioned a very creditable agricultural fair was held in the Province of Cebu in the town of Carcar. Nothing of the kind had ever been attempted before and great interest was taken by the people in this fair. All kinds of agricultural products were exhibited and there was keen rivalry for the prizes offered by the railway company for the best exhibits of different products. Good commercial exhibits of agricultural implements and fertilizers were also made and industrial exhibits were contributed by the schools. During the fair pamphlets and seeds were distributed and an illustrated lecture was given. The enthusiasm shown by the people in all

of the features of this fair indicated that results of permanent value were accomplished.

During the first half of the calendar year 1912 the Province of Cebu suffered from a prolonged and severe drought. Practically all demonstration work had to be abandoned during this period, although an attempt was made to plant a few of the plots, and in one or two instances where water was available excellent results were obtained. During this period of drought the inspectors were occupied in visiting farms, demonstrating methods of seed testing, and furnishing the farmers such other assistance as was possible.

With the coming of the rains in June planting of demonstration plots was immediately taken up. Sixteen plots were planted and this number was later increased to 28.

In the month of May, 1912, swarms of locusts appeared in different parts of Cebu and for nine month thereafter this province suffered from one of the most severe locust infestations in the history of the Islands. The inspector in charge of agricultural work in Cebu was detailed to assist in the locust campaign and devoted a great deal of time to this work. In the midst of this campaign the province was visited during the months of October and November by two extremely severe typhoons which devastated large sections of the island where demonstration work was under way. Following this storm a résumé of the work showed that of 28 demonstration plots planted 11 were harvested and the remaining 17 were destroyed by drought, locusts and the typhoons. The 11 plots that were harvested gave an average of 59.1 cavans of maize per hectare, which was 81 per cent higher than the yields on adjoining lands cultivated by the native methods.

It would be difficult to conceive of conditions more unfavorable than those under which the agricultural demonstration work in Cebu was carried on during the years 1911 and 1912. Within a period of twelve months the province was visited by most severe droughts, locust infestations, and two destructive typhoons. Planting was delayed, crops were damaged, and more than half of the plots were entirely destroyed. The fact that under these conditions definite and positive results were obtained is highly encouraging.

Following the typhoons of November and December, 1912, the planting of demonstration plots was again taken up. Most of the plots planted were on the land adjoining the railway. The crops planted on these plots were maize, cowpeas, tobacco,

and sweet potatoes. Twelve maize plots were planted in the following towns: Two in Simala, 2 in Ocaña, 2 in Carcar, 1 in Sibonga, 1 in Sangat, 1 in Naga, 1 in Minglanilla, 1 in Talisay, and 1 in Banao. The tobacco plots, 3 in number, were located at Carcar, Simala, and Argao. The sweet potato plots were in Simala and Carcar, while cowpeas were planted in Carcar and Naga. During February and March, 1913, 7 of the maize plots were harvested, giving an average yield of 50 cavans of shelled maize per hectare. The average yield of maize on fields adjoining the demonstration plots was 35 cavans per hectare.

The tobacco plots at Carcar and Samala have been harvested, but the yield has not yet been ascertained.

The plot of cowpeas at Naga was equally divided between "New Era" and "Clay" varieties. The former variety made a very vigorous growth and produced a fair crop of seed, but the latter was a failure. The cowpeas planted at Carcar, where the "Clay" variety was used, were also unsatisfactory.

The sweet-potato plots have not as yet been harvested. They consist of two varieties, American and Chinese, and data that will be obtained showing the relative yield of these two varieties will be of interest.

During the first quarter of the calendar year 1913, 5 maize plots, 1 tobacco plot, 1 sugar-cane plot, and 1 sweet-potato plot have been planted.

During the month of March the agricultural inspector in Cebu attended the maize demonstration held by the Bureau of Education in the city of Cebu and presented a good instructive exhibit, showing the nature of the demonstration work carried on in the province. This exhibit was illustrated by photographs and contained selected seed maize, implements, fumigation boxes, and other material. Bulletins and circulars were distributed to interested persons and inspectors were on hand to explain the different phases of the work. On March 24, at the request of the president of the town of Liloan, a maize exhibit was held at that place. Although weather conditions were unfavorable, about 150 people were present and an interesting meeting was held. The exhibit included various implements, seed maize, maize shellers, mills, and, in fact, everything required for the growing and milling of maize.

In connection with the work of the Cebu demonstration project a supply of vegetable seeds is kept on hand at all times as there is a steady demand for such seeds as radish, tomato, pechay,

peppers, and eggplants. These seeds are given away upon request. During the past three months some 300 fine, healthy papaya trees were distributed, and 150 pineapple suckers and a supply of sweet-potato plants were also given away.

The prospects for successful demonstration work in the Province of Cebu are very bright. The farmers now have a clear understanding of the object of the work, and the results obtained last season are beginning to show in improved farming methods. In all sections of the province fields are better planted and cared for than they ever were before. An increased sale of farm implements is a further indication of what is being accomplished by this work. During the past six months, since the demonstration work began to show results, more agricultural implements and machinery have been sold by one company in Cebu than had been sold during the previous four years.

A tract of land near the city of Cebu has been obtained for a demonstration station and an appropriation has been made for the buildings for this station. With the establishment of a central demonstration station and the extension of the plot work more generally throughout the province, the Cebu project will be in a position to rapidly enlarge its sphere of work and should have an important influence in the improvement of agricultural conditions throughout the province.

DEMONSTRATION WORK IN THE PROVINCE OF BATANGAS.

By H. T. NIELSEN, *Superintendent, Batangas Breeding and Demonstration Station.*

Preliminary arrangements for the establishment of coöperative demonstration work in the Province of Batangas were made early in 1912. In October the Batangas breeding and demonstration station was established and active work has been carried on since that time.

The Batangas station is an excellent example of the coöperative spirit that is now being shown in different sections in the work of promoting agricultural improvement. The municipality of Batangas furnished the tract of land, and the province fenced this land, constructed the necessary buildings, dug a well, and has supplied a part of the labor required for the operation of the station. The Bureau of Agriculture has furnished the superintendent and other employees, breeding animals, and equipment. As a result of this coöperation the people of the province and the municipality are keenly interested in the work that is being done.

The work in Batangas Province has consisted largely in arranging for demonstrations to be carried on in the future, most of them to start at the beginning of the rainy season. At the breeding station considerable crop-trial work has been finished up, owing to the coming on of the dry season. The horse-breeding work has been very satisfactory, the services to March 28 totaling 175 for the quarter, and this will likely be increased to 185 or 187 by the end of the month. There is still some difficulty in having sows brought to the station to be served by the Berkshire boar, 17 having been served since December 10 when the boar was received. An effort has been made to induce the owners of sows to bring them to the station, but with rather poor results.

In arranging the demonstration work in the province every municipality has been visited. It has been the policy to call on the officials of each municipality and try to interest them so

that they would help select the coöperators. This gave very satisfactory results in every town except one where there was no interest manifested and where no demonstrations have been arranged for so far. In carrying out this policy much credit is due to the assistant inspector who has shown good tact in meeting the municipal officials and commendable zeal and devotion in getting the work started.

Aside from the rice crop (which is important all over the province), Batangas may be divided into four parts, in each of which there is a very important or major crop. The western part is largely devoted to sugar cane; the northern or northeastern part to oranges; the eastern, in the neighborhood of San Juan de Bocboc, is being mainly planted to coconuts; the southern part around Loboo is principally a corn section. The central part, including the country between the towns of Lipa, Batangas, Taal, and Cuenca, grows rice, corn, and sugar cane largely, and oranges to a very considerable extent.

The things which are especially worthy of note are the following: The generally poor condition of a great many of the orange trees in the neighborhood of Santo Tomas and Tanauan, various things having contributed to this state of affairs; generally poor care is given the trees, which are neither pruned, sprayed, or cultivated in most cases; the long severe drought of 1911 and 1912 undoubtedly seriously weakened the trees so that disease and insects have found it easy to gain a foothold. Pruning and cultivation will help very materially in correcting the troubles.

The rich looking and highly productive soil of the eastern part of the province is striking. Its comparative inaccessibility militates decidedly against its development, although this section will undoubtedly make great progress with the opening of a first-class road, and possibly a spur of the Manila Railroad, into the territory.

The productivity of the soil in the neighborhood of Loboo is also worthy of note. There were seen many fine fields of corn which would yield far more than the Philippine average. The amount of corn on hand is also a striking feature, as there were great stacks of dry corn at nearly every house.

The western part is evidently generally prosperous, due very largely to good yields of sugar cane. Two modern sugar mills are to be installed in this part of the province, one on the Roxas estates at Nasugbu, and the other a coöperative affair at Balayan. Another interesting feature in this section is the apparently successful (and it is believed profitable) growing of bush cotton

between the towns of Balayan and Calaca. Several small fields were seen there and all looked quite well.

The great central part deserves comment principally on account of the large amount of land under cultivation. A very large percentage of the arable land is now being cultivated.

The demonstration work as arranged for comprises 40 trials or plots. They are distributed among crops as follows: Corn, 31 plots; rice, 3 plots; orange-tree prunning, 3 plots; sugar cane, Hawaiian varieties, 3 plots. The latter will probably have to be abandoned for the present, because there is no seed cane available. According to towns the distribution of plots is as follows:

Nasugbu	3
Tuy	2
Balayan	2
Calaca	2
Taal	3
Bauan	3
Alitagtag	2
Cuenca	2
Loboo	2
Ibaan	2
San Jose	4
San Juan de Bocboc	3
Rosario	1
Lipa	2
Tanauan	4
Santo Tomas	2
Talisay	1
Total	40

The corn-demonstration work is planned to give double comparisons. Two varieties are used in each trial, Moro and the native variety grown locally. Each variety is planted in the way customary in the neighborhood, and also in plots where the hills are 1 meter apart each way, and two stalks to the hill. The arrangement is as follows: Native corn, in hills 1 meter apart each way, 2 stalks per hill; Moro, 1 meter hills.

All the coöperators have been strongly urged to plow as deeply as possible.

Nearly all the farmers have been anxious to coöperate in rice work, but it has not seemed practicable to take up this work at present. At one place we were satisfied the rice was being planted too thickly, so a plot of thinner planting will be grown by the side of the other for comparison. Two growers will each

have a plot of deeply plowed land in comparison with plowing of the usual depth.

In the coöperation in prunning orange trees young trees have been selected, and an effort is being made to develop them into trees as symmetrical as possible. The coöperators also have agreed to cultivate them according to our directions. Part of the trees are left as found for a comparison. There appears to be very great opportunity for doing good in this field.

At the breeding station the corn work all turned out rather better than was expected. Moro and Iloilo white were the best in the trials comprising Moro, Iloilo White, Iloilo Yellow, Golden King, Yellow, 90-day, and Clarence Wonder. The planting was in 1 meter hills. Ninety-day and Yellow were unsatisfactory.

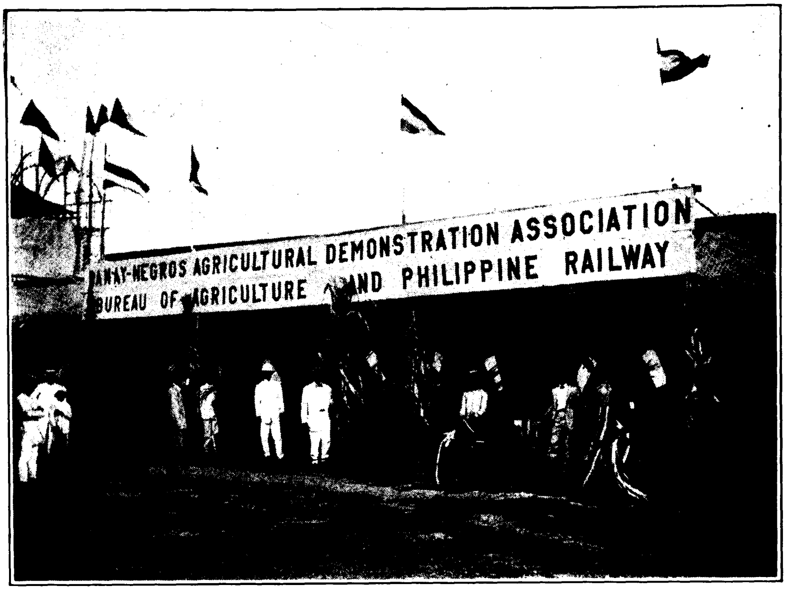
Of the other things planted on the station grounds, Rhodes grass has done very well and considerable seed has been saved. Guinea grass has been growing entirely satisfactorily all the while, and *Chloris virgata* No. 1682, Red amber 17548, Lyon bean, *Dolichos lablab,* Clay cowpea, Guar, and *Canavalia* sp. have all made a fairly satisfactory growth. Ants and plant lice have bothered all of the legumes except guar and *Canavalia.*

The breeding work at the station, under the direction of Mr. G. H. Burns, has been entirely satisfactory, and the stallions have been in the very pink of condition practically all of the time. As it is not at all uncommon for 10 and 12 mares to come to the station in one afternoon it has required tact and judgment to manage so as to prevent complaints. There seems to be no let up in the number of mares coming to the station, and only a few of them come from any distance. The stallions are being worked to their full capacity, and should probably have a rest, or at least lighter work, ere long. Many requests are received from Lipa and from Calaca and Balayan that one or two stallions be placed in each of those localities for a while, but there seems to be plenty of work here for the four stallions now at the station.

Maize plot at the Iloilo demonstration station.

(*a*) A Cebu demonstration plot.

(*b*) Maize grown on a Cebu demonstration plot.

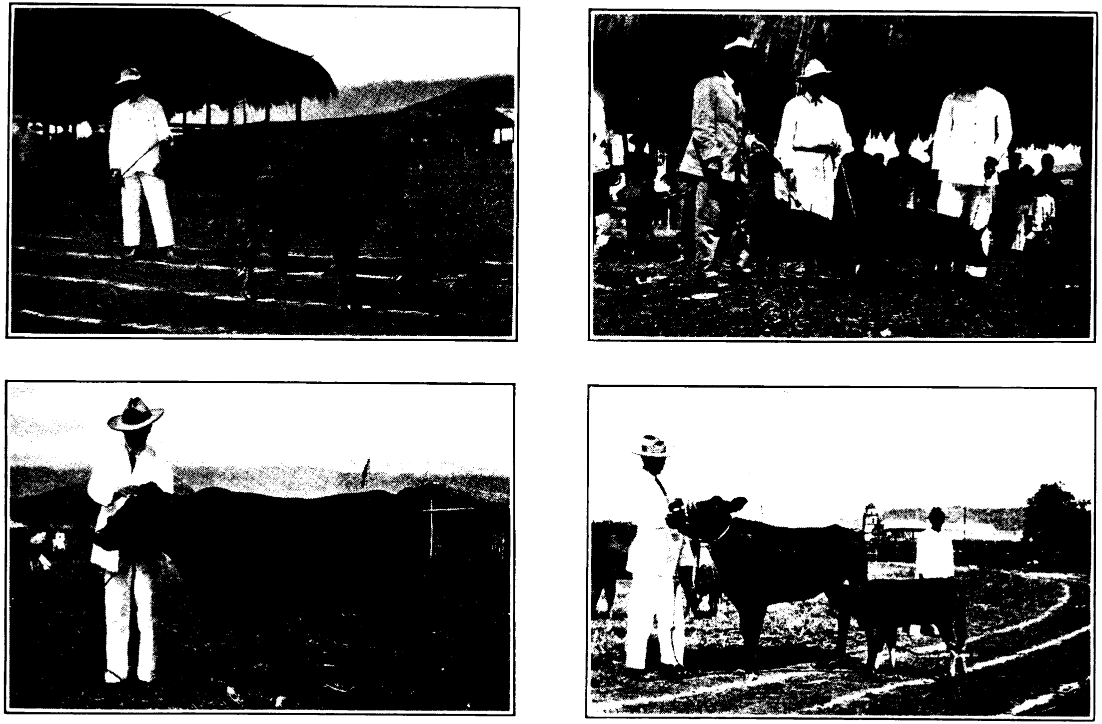


(*a*) Demonstration exhibit at the 1913 Iloilo fair.

(*b*) Products of the demonstration station shown at the 1913 Iloilo fair.

(*a*) "Beder, jr.," a mestizo stallion at the Batangas station.

(*b*) Native mares shown at the 1913 Batangas live-stock show.



Live stock shown at the 1913 Nueva Vizcaya agricultural fair.

DEMONSTRATION WORK IN THE MOUNTAIN PROVINCE AND NUEVA VIZCAYA.

By AUSTIN M. BURTON, *Agricultural Inspector.*

The territory covered by demonstration project No. 6, "Mountain Province and Nueva Vizcaya Demonstration Work," includes the Province of Nueva Vizcaya and the seven subprovinces of the Mountain Province, namely, Benguet, Lepanto, Amburayan, Bontoc, Kalinga, Ifugao, and Apayao. These two provinces include not only a very large area, but also widely varying conditions ranging from those of the tropical lowlands found in the coast regions of Amburayan and Apayao and in the interior valley of Nueva Vizcaya to the approximate temperate zone conditions found in the higher altitudes of the Mountain Province. There is, also, an equally wide difference in the people who live in these regions. Under these circumstances very careful judgment must be exercised in the methods used, and in the distribution and planting of seed over this large area in order that the work done and the seeds and plants distributed may be entirely suited to the local conditions of each particular district.

This project is supervised by an agricultural inspector, who organizes and directs the entire agricultural work of the two provinces and makes regular inspections of the territory covered by the project. Three assistant agricultural inspectors are now detailed in different subprovinces, and this number will be increased until each subprovince shall have at least one inspector. Each assistant inspector is expected to become thoroughly familiar with the people and the local conditions of his district and to carry out in detail the demonstration work within that district. In addition to the employees of the Bureau of Agriculture assigned to this work many of the local officials of these provinces are rendering highly efficient and valuable assistance.

The general plan of work for this project is the same as that of the demonstration projects in other parts of the Archipelago, namely, to promote the improvement of agricultural conditions by furnishing the farmers practical advice and assistance, and

by the establishment of coöperative demonstration plots in different localities. Every effort is made to adapt this work to the needs and the desires of the people, and to keep it within such limits that it may in all cases be practical. The crops worked with are largely those which are already cultivated, the main effort being to secure a wide distribution of selected seeds and plants, and the gradual introduction of better cultural methods.

In the subprovince of Benguet work was carried on by the Bureau of Agriculture for a number of years previous to the establishment of the demonstration project. The headquarters for this work was the Trinidad garden, where both investigational and demonstration work has been undertaken. As a demonstration station the Trinidad garden has accomplished excellent results. These results can now be seen in the flourishing gardens to be found throughout the municipality of Trinidad. The station has been used for the production of seeds and plants and as a headquarters for seed distribution. The people to whom these seeds were given have been visited by the superintendent of the garden and have been furnished instruction in methods of planting and culture. The thriving gardens of Trinidad now furnish an abundant supply of strawberries, peas, beans, radishes, turnips, carrots, lettuce, and other produce of the Temperate Zone. This produce is used and appreciated by the people themselves, and a great deal is also sold in the Baguio market, thus adding considerably to the income of the people who have been industrious and farsighted enough to take advantage of the opportunities offered them. The larger part of the area of the Trinidad garden has now been leased for a commercial market garden, the remainder being used for seed production. With the establishment of the demonstration project an effort is being made to carry throughout the subprovince of Benguet by means of seed distribution and demonstration plots the work that has been done in Trinidad.

In the subprovince of Bontoc the demonstration work has been greatly aided by the provincial governor, who has placed the work in the jail garden under our supervision and has furnished prison labor and an efficient foreman. This garden is well located, having good soil, irrigation, and drainage, and has produced very good yields of peas, beans, radishes, turnips, beets, lettuce, okra, squash, mustard, peppers, papaya and other crops. The flowers grown from Trinidad garden seed and distributed from propagation beds in Bontoc to different residents have done well and have helped to beautify the town. Ten loquat trees grown from seed

obtained in Sagada are thriving, and will soon be ready for transplanting. Some American sweet-potato plants taken from the Trinidad garden and planted in Bontoc during the first part of January, 1913, are growing well and appear promising. As the camotes (sweet potatoes) grown in the vicinity of Bontoc are poor both in quality and yield it is believed that the wide distribution of this improved variety will be very advantageous. In Camillas, Lepanto Subprovince; Natonin, Bontoc Subprovince; and Quiangan and Mayayao, Ifugao Subprovince, sweet potatoes from the Trinidad garden were planted for propagation and distribution, and are thriving in each place.

At the Constabulary post in Natonin, subprovince of Bontoc, very effective aid has been rendered by the officers in planting gardens under our supervision and also in distributing seeds and giving instructions to the people in their district. Some of the crops grown at Natonin are turnips, beans, peas, cowpeas, carrots, and corn.

Vegetable seeds have been furnished the Sagada Mission, where excellent results have already been obtained. The prospects are that a considerable amount of seed can be distributed from the Sagada garden next season.

In Lubuagan, subprovince of Kalinga, the work has been ably carried on by the lieutenant-governor, a man who has great influence among his people, and is interested in improving agricultural conditions. In Kalinga a large variety of seeds have been distributed and planted.

In Amburayan seeds of tomato, eggplant, corn, beans, radish, cabbage, and other vegetables have been distributed among the local officials of the different municipalities who have been given instruction and supervision in planting and caring for them. At present there are being distributed several hundred cacao seedlings in each municipality or township in those sections where conditions are apparently suited to this crop. A few trees are planted by each individual around his home and on this account it is expected that the trees will receive more care and attention and thrive better than would be the case were there a few large plantings made. In Bacun, a township of Amburayan, a number of Liberian coffee trees planted by the Bureau of Agriculture four years ago have borne their first crop. The trees are thrifty, have as yet shown no signs of blight, and the people like the coffee.

In Quiangan the supervising teacher has a large garden. The work in Quiangan has been considerably interfered with by the

depredations of rats, but even with this drawback good results have been obtained with beans, turnips, okra, lettuce, and radishes, and present indications are that cowpeas, corn, peas, and sweet potatoes will turn out well. The corn has been planted with a small lattice work of "runo" around each hill to keep the rats from eating the young shoots. The leaves of a bed of okra were attacked by leaf-eating beetles, but a stop was soon put to their depredations by the application of a Paris green and soap spray. The gardens in Quiangan are much noticed by the head men of the Ifugaos and seed is being raised for further distribution.

Work in Nueva Vizcaya, a very promising province, has been carried on by an assistant agricultural inspector, who distributed seed and furnished instructions to the local officials and influential people of the different sections and at the same time stimulated interest in the agricultural fair recently held. This inspector officiated as one of the judges of the exhibits at this fair and was thus given an opportunity to impress upon the people the fact that a steady improvement of their crops would be the result if they used the same care in selecting seeds as they used in the selection of their products for exhibit. Fortunately the principle of "like begets like" was well exemplified in the cattle and pigs exhibited, and by drawing a parallel between the animal and vegetable kingdoms the principle was impressed upon many more strongly than it would have been if advanced in the abstract, and will doubtless be followed by some of the more progressive farmers.

In developing the demonstration work in the Mountain Province and Nueva Vizcaya special attention will be given to the lines of work already mentioned. As the people of these provinces gradually come to have a better understanding of the value of improved methods, such new lines of work will be taken up as may best meet the requirements of the situation. At the present time arrangements are being made for the planting of seedbeds of coffee, cacao, and Hawaiian papaya in different localities. Using these seedbeds as a source of supply, plants will be as widely distributed as possible in sections adapted to these crops. Another line of work that has already been taken up is the distribution and planting of improved varieties of maize, the object being to develop a more general interest in the cultivation of maize, and to improve the quality and increase the yield of this important cereal in this section of the country.

EXTENSION WORK IN COÖPERATION WITH THE MANILA RAILROAD COMPANY.

By W. A. MACE, *Agricultural Inspector.*

Two kinds of demonstration and extension work are now being carried on in the United States: First, that which is done by the United States Government, the agricultural colleges, and other Government institutions through the medium of demonstration trains, farmers institutes, and coöperative demonstration work; second, that which is done by some of the most prominent railroad companies, principally by means of coöperative demonstration farms.

The State institutions combine their forces with those of the United States Department of Agriculture in all kinds of extension work. They also send demonstration trains through different sections and hold farmers institutes.

The agricultural demonstration trains which are sent out are generally accompanied by men who lecture on the different branches of agriculture. These trains are stocked with various kinds of agricultural products, statistical material, maps, charts, photographs, etc., which are displayed in the different towns where stops are made. The trains are usually sent out during the summer vacations of the colleges and universities, and a definite schedule is arranged and published in the various county newspapers for weeks before the trips are started.

The railroad companies employ a force of men who have agricultural training and practical experience to do farm demonstration work. These men go out and coöperate with the farmers in an effort to better agricultural conditions. Their salaries and all expenses are paid by the railroad company. They buy what are known to be the best varieties of seed of the different crops for a given locality and sell them to the farmer at cost prices. In coöperative work they strive to induce the farmer to use only up-to-date methods of farming, farm management, building of good roads, and anything which goes toward

the betterment of agriculture in every sense of the word. Some of the railroad companies have regular departments with a large force of employees who do nothing but this kind of educational work.

The reason for this interest in agriculture on the part of the railroad companies may be readily understood. As the farmer becomes better educated and works the soil in a manner which will give the best possible results, he has more produce to put on the market. The railroads naturally profit from the increased traffic. Thus each party is benefited by the coöperation. As an individual the farmer reaps, possibly, the greater profit, as the railroad people are teaching him things which will help him for years to come.

In view of the success which the railroads have had with this work in the United States, the Manila Railroad Company is now constructing a car for the use of the Bureau of Agriculture along the railway lines on the Island of Luzon.

The railroad company provides the car, keeps it in good condition, furnishes light and fuel for the attendants on the car, and transports it over the different lines. The Bureau of Agriculture equips the car with the proper exhibits and furnishes the necessary employees to care for and show the exhibits and lecture to the people in the different towns.

The car which is now being constructed by the Manila Railroad Company for this work is about 14 meters long and 3 meters wide. It will be lettered on each side "Agricultural Demonstration Coach." The interior arrangements provide for an aisle running the entire length of the car, the remaining space being used for exhibition purposes. Separating the aisle from the exhibits is a narrow show case about 3 feet in height. Entering the car from one end with the exhibit on the left-hand side the exhibition space is divided into sections. The first section will contain an agronomy exhibit; then comes in regular order horticultural work, seed distribution, publications, farm implements, and storeroom.

In the agronomy section will be exhibited specimens of the various staple crops grown in the Islands, illustrating improvements resulting from seed selection, plant breeding, use of modern implements, etc.

In horticulture will be shown the different horticultural tools, methods of grafting, budding, seed germination, and various methods of plant reproduction.

In addition to various kinds of seed for free distribution, methods of seed testing and some of the principles of seed selection are to be shown in the section for seeds.

Bureau of Agriculture publications and bulletins from the United States Department of Agriculture will be shown and distributed to persons interested in such printed matter.

The farm-implement section will contain such modern tools and implements as are available and suitable for use in these Islands.

The walls of the car will be covered with photographs, charts, maps, etc., showing the more important phases of agricultural work carried on by the Bureau of Agriculture.

In addition to the exhibit the car will be supplied with a lantern and several hundred lantern slides illustrating agricultural subjects. Meetings are to be held at night and illustrated lectures given on different subjects. Different employees of the Bureau of Agriculture will accompany the car for this lecture work.

It is believed that this demonstration car will tend to stimulate an interest on the part of the farmers in improved agricultural methods, and that it will be an important adjunct to the coöperative demonstration work.

THE NUEVA VIZCAYA AGRICULTURAL FAIR.

By AUSTIN M. BURTON, *Agricultural Inspector.*

The holding of agricultural fairs and exhibits is a popular, and in many ways valuable, means of educational work for the farmers. The number of such fairs in the Philippine Islands is increasing every year, and a marked improvement is being made in the quality, size, and number of exhibits. The following report of the Nueva Vizcaya Agricultural Fair recently held shows that these fairs are worthy of hearty support:

The Nueva Vizcaya Agricultural Fair held in Bayombong from March 7 to 9, 1913, inclusive, surpassed the expectations of its most ardent promoters. The people from different sections of the province took a lively interest in bringing their best produce for exhibit, and consequently a good idea of the productiveness of the province was given. The primary motives for holding the fair were to foster a friendly rivalry in agricultural matters between different sections of Nueva Vizcaya and to attract the attention of outside people to the advantages offered by this province. Nueva Vizcaya has a great deal of rich agricultural land which is uncultivated because there are not enough people to take it up and care for it.

There were exhibits for most of the principal crops of the Islands, among them being creditable displays of many varieties of rice, also exhibits of maize, sugar cane, tobacco, coffee, pineapples, plantains, bananas, camotes, yams, cacao, coconuts, papaya, squash, and a number of varieties of native beans. There were also good exhibits of tomatoes, eggplant, peanuts, potatoes, melons, onions, radish, turnips, endive and other plants not indigenous to the country, the seeds of many of which were distributed by the Bureau of Agriculture.

A considerable amount of industrial work done by the schools and also by private individuals was shown and attracted favorable attention. The industrial display consisted principally of articles of furniture, baskets, home weaving, and embroidered and knitted work.

Specimens of gold, copper, coal, fire clay, and several other minerals, also the miniature salt plant which was operated on

the exposition grounds, showed that Nueva Vizcaya is not poor in mineral resources.

The field and track meet between the different schools of the province was an interesting feature of the fair and was enjoyed by all.

In the live-stock exhibit, the advantage of breeding animals up to a higher type was well exemplified in the animals exhibited by Sr. Genaro Evaristo, of Dupax. The Angus-Chinese bull originally purchased at the Trinidad stock farm, is noticeably larger than the native cattle, and two of his progeny which were exhibited give promise of developing into a much improved type.

In the exhibit of pigs the improvement resulting from breeding to a thoroughbred Berkshire boar was remarkable. One sow with a litter of 9 husky young pigs attracted a great deal of attention and was justly awarded one of the premiums. The fact that as high as ₱25 has been offered for single members of this litter (now about 6 weeks old) may be taken as an indication of the esteem in which these pigs are held. Three other offspring from the same boar were also exhibited and were awarded a prize. They showed marked Berkshire characteristics, indicating the prepotency of the sire.

The farmers of Nueva Vizcaya are not only interested in raising the standard of their cattle and pigs, but are also devoting attention to the improvement of their horses. The provincial government obtained last year, through the Bureau of Agriculture, a New Zealand stallion which has been used for breeding purposes. A native mare and mestizo colt were shown; the latter, though but 1 month old, gives promise of developing into a fine animal.

The gold medal for the best exhibit as a whole was awarded to the town of Dupax. The exhibits from Bayombong and Solano were so creditable that it was only after long and serious deliberation by the committee on awards that Dupax was given this honor.

The success of this fair so far exceeded the expectations of its promoters and so much interest was taken by the different participants that there seems to be no doubt that the "Nueva Vizcaya Agricultural Fair" will become an annual event. The strong feeling of friendly rivalry built up between the different sections will doubtless result in the exhibits for the fair for next year being even better than were those of this year, in which case the fair will be well worth traveling a long distance to see.

FARMERS' COÖPERATIVE DEMONSTRATION WORK IN THE UNITED STATES.[1]

By H. T. Edwards, *Assistant to the Director.*

The farmers' coöperative demonstration work in the United States was first organized by the late Dr. Seaman A. Knapp in Texas in 1904.

It was announced at the time that the object and scope of the work would be to show by actual demonstrations on the farmer's own farm the value of better agricultural methods, the value of good seed and the value of practicing a few simple principles in growing a crop of cotton in sections of the country infested by the weevil. The primary object of this work when it was first organized was to give immediate relief to the farmers in those parts of the country that were suffering from the ravages of the cotton-boll weevil.

Conditions at this time in the weevil-infested sections of the United States were gloomy in the extreme. Cotton was the only cash crop and was largely produced on what is known as the "advance system." The farmers obtained credit for the necessary supplies to make the crop and at the end of the year the merchant or banker took the crop, sold it, paid the indebtedness and returned any remaining balance to the farmer. After the appearance of the weevil the merchants and bankers refused to make advances and the farmers were left without money, food or credit. The result was an agricultural and financial panic. Labor moved away, farms were abandoned and disaster was general throughout this section of the country.

The coöperative demonstration work of the United States Department of Agriculture was organized to relieve this situation, and the work of showing the farmers how to produce cotton in spite of the boll-weevil was undertaken. Agents were sent

[1] The Yearbook of the United States Department of Agriculture for 1911 contains a report, "Some Results of the Farmers' Coöperative Demonstration Work," by Bradford Knapp, Special Agent in charge of Farmers' Coöperative Demonstration Work, Bureau of Plant Industry, on which this article is based.

into the field to show the farmers how to raise a few acres of cotton under instructions prepared by the special agent in charge and at the same time how to increase their food supply by growing corn and planting home gardens. Immediate results were obtained. Cotton was raised in spite of the weevil and more corn was produced than ever before. Diversification of crops was advocated from the beginning, as it appeared certain that the weevil would sooner or later infest all of the cotton-growing sections of the South.

In seven years this work has had a remarkable growth. In 1912 some 600 agents were employed and practically 100,000 farmers in 13 different States were receiving instruction. The system has now become firmly established as a means of carrying helpful knowledge to the farmer on his own farm by placing a demonstration on his land and securing his coöperation in the adoption of the methods recommended.

The more important features of this work are as follows:

1. The direct personal contact of the local agent with the farmer.
2. The participation of the farmer in the demonstration work.
3. The practical certainty of success, under normal conditions, of the methods used.

The farmers' coöperative demonstration work is not essentially a work of investigation. The aim of this work is to take knowledge that has already been acquired by investigation and to give this knowledge the widest possible dissemination by means of demonstration. Its object is to convert the knowledge that has been obtained by experts into common practice of the farmers.

The farmers' coöperative demonstration work in the United States is demonstrating beyond question that cotton can be raised in spite of the cotton-boll weevil. From the very beginning of the work the demonstrators who have carefully followed instructions have, with few exceptions, produced a paying crop of cotton. Widely varying conditions are to be found in different sections of the cotton belt. It has been necessary, therefore, to vary the method used in the demonstration work to meet these differing conditions. In territory beyond the advance of the weevil efforts are being made to demonstrate better methods of crop production, the advantage of seed selection and the production of home supplies so as to be ready to meet the weevil when it comes.

In the majority of cases the actual damage done by the weevil is greatly overestimated as all reduction in the total yield of the

crop is invariably attributed to the weevil. As a matter of fact unfavorable weather conditions and pests other than the weevil have a large part to do with the fluctuations in crop production.

The results obtained by this work can not be easily tabulated or reduced to the form of mere statistics. Some of these results, however, are so important as to be particularly worthy of note. Data were collected from about 12,000 demonstrators representing an acreage in cotton of some 85,000 acres and in corn of about 75,000 acres. The following table shows the increase in yield of cotton and corn obtained on the demonstration farms over the average yield in a number of different States:

Increased average yield of cotton and corn on demonstration farms over the average yield in several Southern States in 1909 and 1910.

States.	Average yield of seed cotton per acre.				Average yield of corn per acre.			
	Demonstrators.		Entire State.		Demonstrators.		Entire State.	
	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Bus.*	*Bus.*	*Bus.*	*Bus.*
Eastern Texas	690.6	826.1			28.4	34.1		
Western Texas	547.5	578.4			21.8	31.5		
Texas (entire State)	633.3	710.4	375	435	25.4	32.8	14.7	20.6
Oklahoma	527.7	708.1	441	600	26.0	24.1	15.9	16.0
Louisiana	757.8	785.5	390	360	30.8	35.2	16.3	23.6
Arkansas	844.6	915.3	459	525	30.6	36.8	16.5	24.0
Mississippi	1,115.7	933.5	471	546	36.9	41.6	13.1	20.5
Alabama	1,138.4	1,220.2	426	480	33.2	41.4	11.9	18.0
Florida	597.5	572.0	330	330	21.0	23.0	11.3	13.0
Georgia	1,303.9	1,298.0	552	519	34.4	35.4	11.6	14.5
South Carolina	1,204.9	1,294.3	630	648	36.1	41.0	13.3	18.5
North Carolina	1,238.2	1,332.7	630	681	40.0	43.4	13.9	18.6
Virginia					41.0	46.5	20.6	25.5

Special attention has been given to the work of establishing diversified farming throughout different sections of the south.

The one-crop system has generally proven a failure as a permanent system of general farming. By the introduction of diversification it is possible for the farmer to produce most of his home supplies, such as vegetables, meat and other food products, to produce enough corn, hay and forage for a profitable live-stock business, to use leguminous crops for increasing the fertility of his soil, and to grow cotton as a cash crop. Under this system of farming a larger production per acre is obtained and the farmer is not dependent upon the fluctuating price of some one crop.

The work that has been done in arousing a widespread interest in the live-stock industry has been most important. It has been amply demonstrated that the South can produce the necessary feed for live-stock and in different sections the farmers are now

taking up dairying or hog raising as a result of the demonstration work.

The demonstration agents constantly advocate the use of more horsepower and less hand power on the farm. It is not unusual to find in different sections of the South where the demonstration work has been carried on for a few years that more farm tools and implements have been sold in the last two years than were sold in the twenty years before.

A great advance has been made in the coöperative feature of this work. This is amply demonstrated by the strong financial support which is now being received. The late Dr. Seaman A. Knapp once made the statement that this work first influenced the individual, next the community and finally the public opinion of the State. In the United States this third period of development has already been reached. For a number of years past individual associations of business men and farmers and county governments have been making voluntary contributions to assist the Department of Agriculture in extending the demonstration work. These contributions have been made in order that the work could be extended to sections where it could not otherwise be carried on because of lack of funds. With the large force of men now employed, with the actual results in increased crop production plentifully in evidence, and with the generally improved conditions in the sections where demonstration work has been carried on, public opinion has been strongly influenced. The States of Virginia, North Carolina, Alabama, Arkansas, Mississippi, and Texas have recently passed laws permitting county boards of supervisors to appropriate money for the purpose of coöperating in the demonstration work. The amounts appropriated in the different States vary from ₱10,000 to ₱50,000 per annum. In Alabama the appropriation has been such as to make it possible to place a local agent in every county. In North Carolina, Arkansas, and Texas the counties are paying at least half of the salary of the local agents.

In addition to the assistance furnished by different States and counties the agricultural colleges in different States are furnishing a great deal of assistance. The agents of the Department of Agriculture are everywhere endeavoring to coöperate with the agricultural colleges and experiment stations and all other forces working in the same general field.

To sum up the entire situation it may be stated that for every dollar appropriated by Congress for the support of the demonstration work in the Southern States an equivalent sum is devoted

to it from some other source. In other words, the people themselves are duplicating the appropriations made by the United States Government. All of this coöperative work is carried on in the most cordial and helpful manner and with practically no friction.

The farmers' coöperative demonstration work deals with the practical problem of producing crops upon the farm, and it takes to the farmer information helpful to him in a business way as well as information which enables him to obtain larger and better crops. The primary object of this work is to so guide the farmer that he may make the maximum yield at the minimum cost. The demonstration inspectors often help the farmers by practical suggestions of a business nature. A few hints as to how money may be saved by producing upon the farm supplies ordinarily purchased tends to create a desire for ownership of land. It has repeatedly been observed that the better class of tenants who have become demonstrators soon begin to consider the question of buying a farm. The reports from all agents show a tendency in this direction. Many demonstrators who were formerly in debt have subsequently reported that their indebtedness has been entirely wiped out and that they now have money in the bank. Reports also show that a large number of tenants, after several years of demonstration in coöperation with the Department, have purchased farms.

In the Yearbook of the United States Department of Agriculture for 1909 the late Dr. Knapp stated as follows:

> The farmers' coöperative demonstration work may be regarded as a method of increasing farm crops and as logically the first step toward a true uplift, or it may be considered a system of rural education for boys and adults by which a readjustment of country life can be effected and placed upon a higher plane of profit, comfort, culture, influence, and power.
>
> There is much knowledge applicable and helpful to husbandry that is annually worked out and made available by the scientist in the United States Department of Agriculture and in the State experiment stations and by individual farmers upon their farms, which is sufficient to readjust agriculture and place it upon a basis of greater profit, to reconstruct the rural home, and to give to country life an attraction, a dignity, and a potential influence it has never received. This body of knowledge can not be conveyed and delivered by a written message to the people in such a way that they will accept and adopt it. This can only be done by personal appeal and ocular demonstrations. This is the mission of the farmers' coöperative demonstration work, and it has justified its claims by the results.
>
> The demonstration method of reaching and influencing the men on the farms is destined ultimately to be adopted by most civilized nations as a part of a great system of rural education.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

MARCH, 1913.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Abacá (Manila hemp).				Sugar, Iloílo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27	2.8	25.3	3.6	25.2	17	27.8	------	24.4	12.7	25.8	------
2	25.8	5.8	26	------	25.6	5.1	28.3	------	23.4	8.9	25.7	------
3	26.1	------	25.9	------	26.1	------	28.8	------	23.5	10.6	25.5	------
4	26.8	4.2	26.6	------	26.5	------	28.6	------	23.8	5.6	26.3	------
5	26.3	8.1	26.5	------	26.6	------	27.4	------	22.1	34.7	28	------
6	26.8	15	27	------	26.9	.8	28.8	------	24	5.6	27.2	------
7	26.1	22.9	24.9	15.2	26.3	------	28.8	9.7	25.2	------	27.4	------
8	27	2	26.4	------	27	------	28.8	------	25.6	------	28	------
9	27.6	3.3	26.8	3.3	27.9	------	28	------	25.5	2.3	27.8	------
10	27.6	------	27.3	------	27.6	------	29.4	------	25.2	3.3	27.9	------
11	27.1	2.3	26.8	2	27.5	------	29.7	------	25.3	------	27.8	------
12	26.7	------	27.2	------	27.8	------	29.6	------	25.2	------	27.4	------
13	26.8	------	28	.5	26.8	------	29.7	------	25.6	------	26.6	------
14	27.2	------	27.4	4	27.4	------	30.3	------	25.6	------	27.5	------
15	27.7	------	27.4	------	27.5	------	27.8	------	25.4	------	27.3	------
16	28	------	28.1	------	27.4	------	28.2	------	26.1	------	27.9	------
17	27.6	.3	27.6	------	27.4	------	28.4	------	25.7	------	27.4	------
18	27.4	1.8	27.6	------	27.5	------	28.8	------	26.2	------	26	------
19	27.6	.5	27.6	------	25.9	1	27.2	------	26.4	------	27.4	------
20	27.8	------	27.8	------	27	------	26.8	------	26.6	------	27.6	------
21	26.7	------	26.9	------	26.8	------	28.5	------	26.1	------	27.2	------
22	26.3	------	26.5	16.2	26.6	------	29.3	------	27.1	------	27.1	------
23	26.4	------	27	------	27.4	------	30	------	26.4	------	27.1	------
24	26.8	------	27.6	------	27.3	------	29.1	------	26.6	3.8	27.4	------
25	25.5	------	27.5	------	26.6	------	27.8	------	24.9	4.3	26.5	------
26	27.4	------	27.4	.5	26.8	------	29.9	------	23.6	3	27.4	------
27	26.1	------	26.4	9.1	25.9	------	27	------	24.8	28.4	27	------
28	26.2	4.1	26.7	1.8	26.8	------	28.6	------	26.2	------	28.1	------
29	27.5	2.3	27.6	------	27.5	------	29.1	------	26.9	------	27.7	------
30	27.3	7.1	27.1	1.5	26.8	------	28.6	------	26	------	28.6	------
31	27	9.4	27.3	------	27	------	27.2	------	26.6	------	27	------

ORGANIZATION LIST, BUREAU OF AGRICULTURE.

CENTRAL OFFICE.

Manila, P. I.

Director, FREDERIC W. TAYLOR.

Assistant to the Director, H. T. EDWARDS.

DIVISIONS.

Clerical	W. E. COBEY, A. B., Chief.
Finances and Property	T. R. FLACK, Chief.
Animal Husbandry	C. W. EDWARDS, B. S., Acting Chief.
Veterinary	A. R. WARD, B. S. A., D. V. M., Chief.
Agronomy	C. M. CONNER, B. S. A., B. S., Chief.
Horticulture	O. W. BARRETT, B. Sc., Chief.
Fiber	M. M. SALEEBY, B. A., Chief.
Demonstration and Extension	H. T. EDWARDS, B. S., Chief.
Publications	S. STICKNEY, A. B., Chief.
Statistics	BENJ. P. LUKENS, A. B., Chief.
Machinery and Construction	Vacant.

TECHNICAL ASSISTANTS.

Horticulturist, P. J. WESTER.
Assistant Horticulturist, H. H. BOYLE.
Entomologist, C. R. JONES.
Assistant Entomologist, D. B. MACKIE.

AGRICULTURAL INSPECTORS.

H. R. REED. W. A. MACE.
F. P. NICKLES. F. C. KINGMAN.
H. O. JACOBSON. I. C. ROOT.

STOCK FARMS.

Alabang	Rizal	Dr. H. F. HUNGERFORD, Superintendent.
Trinidad	Benguet	A. L. BRADLEY, Acting Superintendent.

EXPERIMENT STATIONS.

La Carlota	Occidental Negros	H. J. GALLAGHER, Superintendent.
Lamao	Bataan	P. J. WESTER, Horticulturist in charge.
Singalong	Manila	W. N. BIRCH, Superintendent.

DEMONSTRATION AND BREEDING STATIONS.

Iloilo	Iloilo	SAM H. SHERARD, Superintendent.
Cebu	Cebu	E. F. SOUTHWICK, Acting Superintendent.
Virac	Albay	E. H. KOERT, Superintendent.
Batangas	Batangas	H. T. NIELSEN, Forage Expert, Superintendent.
Ilagan	Isabela	O. S. SORIANO, in Charge.
Trinidad Garden	Mountain	AUSTIN M. BURTON, Superintendent.

FORAGE FACTORY.

Pandacan	Manila	W. F. RODGERS, Superintendent. D. F. COYNER.

VETERINARY RESEARCH LABORATORY.

Dr. WILLIAM H. BOYNTON, Pathologist.
Dr. C. H. SCHULTZ.
MAURICE B. MITZMAIN, Veterinary Entomologist.

QUARANTINE STATIONS AND MEAT INSPECTION.

Dr. F. W. WOOD, Supervising Veterinarian in charge.

Pandacan Quarantine Station	Vacant.
Manila Matadero	R. W. NEWCOMB, Veterinarian.
Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.

VETERINARY FIELD FORCE.

SUPERVISING VETERINARIANS.

Charles G. Thomson. Stanton Youngberg. Charles H. Leavitt.

VETERINARIANS.

J. B. Bell.
W. R. L. Best.
H. W. Burkland.
P. H. Burnett.
John R. Burns.
W. A. Curtis.[1]
W. L. Davis.
Charles H. Decker.
Frank Edwards.
George H. Elliott.
Vicente Ferriols.
L. W. Fisher.
John L. Gross.
Thomas Hartman.
James Hill.
William K. Howard.[1]
A. H. Julien.
Harry F. Kern.
William A. Kliphardt.[1]
Walter A. Korb.
A. M. Meade.
Calloway C. Middleton.
A. D. Miller.
Walter J. Palmer.
Donald B. Palmer.
John D. Reardon.
Dallas W. Shaffer.
A. S. Shealy.
J. A. Thompson.
Harry E. Trawver.[1]

[1] On leave.